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THE GRASSLANDS OF NEW ZEALAND.

PRINCIPLES OF PASTURE ESTABLISHMENT.

(Continued.)

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SHORT-ROTATION GRASSLANDS: SHINGLY RIVER DEPOSITS AND SECOND-CLASS PLOUGHABLE LAND IN GENERAL.

THIS class occupies many types of soil, and the name short-rotation grasslands is given because the pastures on such soils are, generally speaking, short-lived, and enter into a short-rotational system of farming. Usually perennial rye-grass and red clover are the main species used, and when these have run out and given place to weeds or weed grasses, or are eaten out by grass-grub, the area is ploughed and put into annual crops, such as cereals, roots, and forages, and then back again into grass for another period of three years. In general, all the ploughable country that will not hold perennial rye-grass for more than three years comes under the category of short-rotational grassland soils.

The factors which influence the running-out of the perennial rye-grass on these soils are very perplexing, but the prime causes may be summarized as follows: (1) Lack of soil-fertility; (2) lack of soil-moisture; (3) openness of plant association so frequently found on such soils; (4) competition with plants better adapted to soils of low fertility; and (5) stocking.

Soil-fertility undoubtedly governs to a very large extent the longevity of perennial rye-grass, but it is not the most decisive factor. Perennial rye-grass often will persist as a small stunted plant even on poor soils, provided there is not too much drying-out of the surface layer. The effect of manurial top-dressings is to stimulate these plants to greater growth, and their presence in the pasture then becomes more noticeable. The rye-grass plants in their stunted condition can persist if they are associated with not too vigorous a rival, but just as soon as plants more naturally adapted to that particular soil come in the rye-grass in its weakly condition is rapidly smothered out. Thus where the soil-fertility is not high but yet favourable for poorer types of grasses there is certain to be a replacement in that association. On such country, therefore, an increase of soil-fertility by top-dressing with artificial

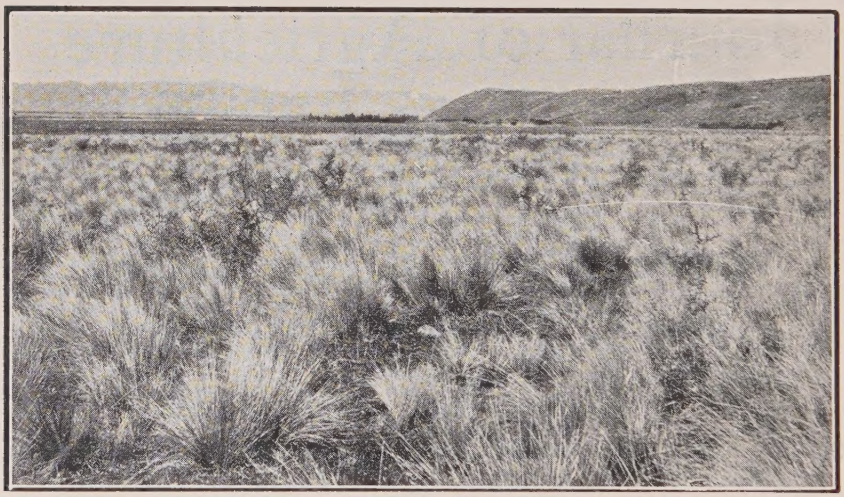

FIG. 49. TYPICAL SHORT-ROTATION GRASSLAND COUNTRY IN CANTERBURY, OCCUPIED BY NATURAL VEGETATION—POA TUSSOCK (POA CAESPITOSA) AND WILD-IRISHMAN (DISCARIA TOUMATOU).

fertilizers will have a greatly beneficial effect on the longevity of the perennial rye-grass, because when the latter is growing well there are few plants that are able to compete with it.

A good example of the influence of surface-manuring and the response which perennial rye-grass gives to such treatment is well illustrated in Figs. 50 and 51. In Fig. 50 the pigs are grazing on what was considered to be an almost pure cocksfoot pasture thirteen years old, and certainly the rye-grass contained in it was scarcely noticeable. The land is typical short-rotation grassland soil, but holds cocksfoot fairly well. In the shelter of the cocksfoot—by no means a vigorous cover-plant under grazed conditions—the rye-grass just managed to persist. Fig. 51 shows a portion of the same field after pigs had been grazing there for less than two years. No seed had been sown nor straw carted on to these pig-paddocks, but within those two years the grass associa-

tion had changed almost completely from a pure cocksfoot pasture to one of almost pure perennial rye-grass, the great growth of the latter being induced simply by that surface-manuring for which pigs are so noted. This affords a very interesting case of the persistence of perennial rye-grass when associated with not too vigorous a rival, but yet one which afforded sufficient cover to prevent establishment of such grasses as red-top, &c. On other paddocks on this same class of soil, where but a weak open association of cocksfoot was secured, replacement by red-top soon took place to the elimination not only of all the rye-grass but of almost all the cocksfoot as well (see Fig. 18 of series, which photo was taken in the adjoining paddock).

Great, however, as is the fertility factor, the longevity of perennial rye-grass may be associated with the mechanical condition of the soil and the consequent soil-moisture content, which will be influenced by the open or closed association of plants growing on the surface. Bare spaces in a pasture mean baking and cracking of the surface and exposure of the basal stem portions to drying winds (Fig. 52). It has been before pointed out that the well-being of most grasses depends on their being able to form a new root-system for each growing-period, and perennial rye-grass proves no exception (see Fig. 4 of series, which is a photo of rye-grass taken from a plant growing on the roadside). Its crown is above ground, and hence its new root-system will be developed at the soil surface. If dry, exposed conditions prevail such root-development is impossible. Whether conditions are favourable or unfavourable for this new root-system to develop will decide whether the rye-grass will "hold" or will "go out." This is the cardinal factor. How often have the roadsides been the envy of the farmer! The longevity of rye-grass along the roadsides is due mainly to the fact that the basal stem portions are covered with a mulch of sand-particles, which keeps such portions moist and thus renders fresh root-development possible (Fig. 53). Manure from the road will help once the root-system is developed, but the mulch of sand is the prime factor. The remarkable growth of lawns, &c., following a top-dressing with soil or even pure sand is accounted for by this fact.

OUTSTANDING QUESTIONS.

The successful grassing of short-rotation soils is full of economic problems which only more definite research work can settle. Four outstanding questions present themselves: (1.) Is it better to sow mainly perennial rye-grass and to plough up as soon as the rye-grass runs out—say, every three years—and sow down to other crops or fresh pasture, or, in other words, to adopt a short-course rotation? (2.) Just where is it economical to break up the land, as against leaving it in the rough natural state and taking from it the natural vegetation that it provides? (3.) Should the area be sown down to more permanent grasses than perennial rye-grass, such permanent grasses to be kept going by top-dressing with artificial manures? (4.) Can a transition to a permanent fairly high-yielding grass be arranged—a grass or grasses that will take up the running after the short-rotational elements have gone out, thus eliminating the necessity for ploughing up before six to eight years?

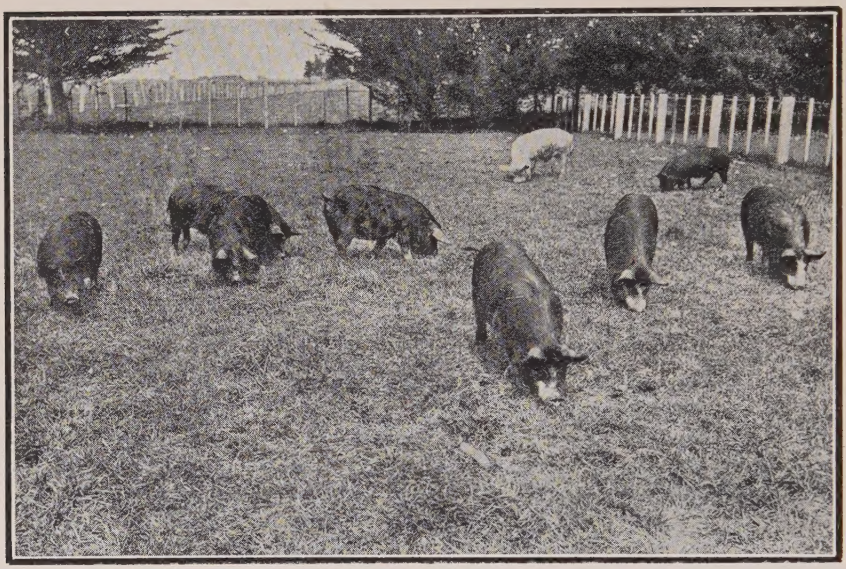

FIG. 50. A DEMONSTRATION OF THE RESPONSE OF PERENNIAL RYE-GRASS TO SURFACE-MANURING.

Pigs newly turned on to an almost pure cocksfoot pasture, thirteen years old, with negligible quantity of spindly rye-grass plants still subsisting.

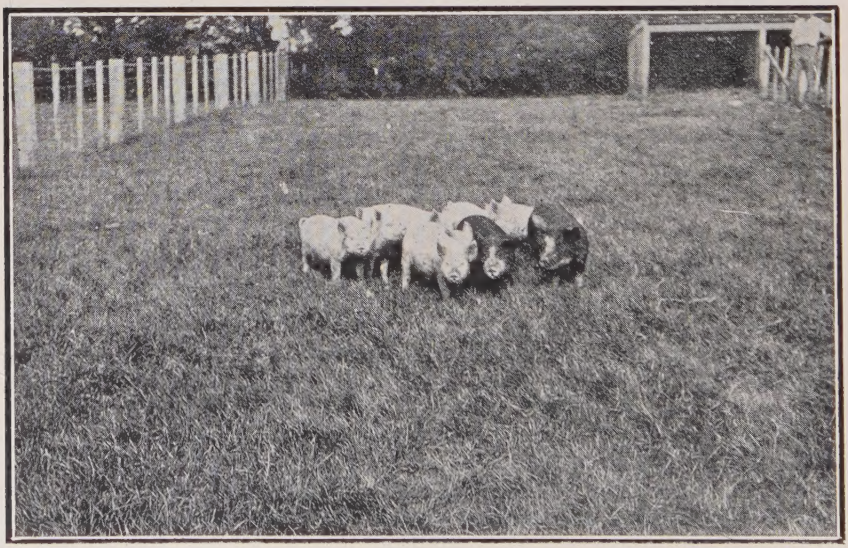

FIG. 51. THE SAME PASTURE AS IN FIG. 50, TWO YEARS LATER, WITH RYE-GRASS NOW BECOME THE DOMINANT CONSTITUENT.

The transition was due to increased soil-fertility effected by the droppings of the pastured pigs.

FIG. 52. ONE-YEAR-OLD SHORT-ROTATION PASTURE (LIGHT SOWING) IN NORTH CANTERBURY, SHOWING BARED GROUND AND EXPOSED RYE-GRASS PLANTS.

Photo taken in November, when the bared spaces were already beginning to open up by cracking which must result in a direct loss of soil-moisture

FIG. 53. PERENNIAL RYE-GRASS GROWING ON ROADSIDE.

Note the mulch of sand which covers the basal stem portions, thus keeping cool and moist these portions of the plant from which young roots arise.

(1.) *The Short-course Rotation.*

As in the case of the first-class lands, there seems little doubt that the short-rotational system of farming is productive of more produce. Provided the plough is kept going and fertility is maintained these soils will produce well, though the cost of that product may be high. Generally speaking, however, it is not feasible for the farmer to do all the ploughing necessary to run such a short-rotational system on a farm large enough to afford a comfortable livelihood. Consequently the pasture portion may be left down longer than three years and become virtually non-productive, growing weeds such as rib-grass and inferior grasses such as sweet vernal, hair-grass, and goose-grass (see Fig. 2 of series, which is a typical succession on short-rotation grassland soils). It would appear that even when the short-rotational system is adopted a certain portion of the farm should be laid down to more permanent grasses than perennial rye-grass. Granting this, the farm should be divided up into (1) a short-rotational area, where only perennial rye-grass and red clover are used in the pasture association; and (2) a long-rotation area, where grasses other than the short-lived ones are used, thus—

Short-rotation portion: Pasture three years, followed by two or three successive annual crops, and back to pasture for another three years. The pasture mixture suggested in this case is perennial rye-grass, 25 lb., and red clover, 6 lb.: total 31 lb. per acre.

Long-rotation portion: Pasture six to eight years, followed by two or three successive annual crops, then back to pasture again for the six- to eight-years period. In this case the following mixture is suggested (varying according to special conditions): Cocksfoot, 15 lb.; crested dogstail, 4 lb.; perennial rye-grass, 10 lb.; Timothy, 2 lb.; red clover, 3 lb.; white clover, 2 lb.: total, 36 lb. per acre.

The question of soil-improvement so that perennial rye-grass will hold on the present short-rotation grassland soils is a very important one, and one on which advice is frequently asked. By converting our second-class soils into first-class soils it is possible to get perennial rye-grass to hold, but, unfortunately, the expenditure in work and manuring is too great for wholesale application. The process, if practicable at all, would have to be done acre by acre, and it is work that the pioneer settler can do very little at. Many soils are met with that are really too poor to attempt to improve as yet. It is to such soils that the second question applies in the present discussion.

(2.) *Poor Soils under a Natural Grass Cover.*

This question applies really only to those very poor lands which the farmer is holding at a more or less nominal rate. The natural vegetation may be danthonia, tussock, &c., which provides a certain amount of feed at a very low cost to the farmer, and where large tracts of this country are available it is perhaps a sounder proposition to take from such lands the feed that it naturally provides rather than to adopt any methods which involve expenditure for improving the sward. When its value advances, however, that land has to be made to produce more than the natural vegetation it provides.

FIG. 54. PERMANENT PASTURE MAINLY COMPOSED OF COCKSFOOT AND CRESTED DOGSTAIL, WITH RED AND WHITE CLOVER, ON TYPICAL SHORT-ROTATION SOIL AT ASHBURTON.

Note how the crested dogstail (some plants of which are marked ×) fills up between the cocksfoot-plants, thus helping to form a complete turf. Pasture three years old when photographed.

FIG. 55. CHEWINGS FESCUE IN THE MOSSBURN DISTRICT TAKING UP THE RUNNING ON TYPICALLY POOR SHORT-ROTATION SOILS, AFTER THE PERENNIAL RYE-GRASS AND CLOVER HAVE RUN OUT.

(3.) *Permanent-pasture Establishment by Direct Sowings of Permanent Species.*

The consideration of grasses other than perennial rye-grass should claim the attention of the farmer on many of our short-rotational grassland soils, particularly so for pastures of longer than three years' duration on a portion of the farm. The period of low productivity that pastures are often left to undergo on the running-out of the rye-grass is one of direct loss. With more permanent grasses although the first year or so may not be so highly productive the continuous feed until the paddock is again needed for cropping should well repay the additional expenditure involved. It must be accepted as a general principle that in the establishment of truly permanent pastures on these soils any plants that are short-lived should not figure largely in the mixture sown. They establish rapidly and hinder the establishment of the truly permanent elements. They go out in the course of a year or so, and bare ground will appear, the ill consequences of which must now be recognized. On good land the plants if thinly spaced have at least an opportunity of spreading out over any bare spaces (if weeds do not forestall them), but this is not the case with the species that are used on poorer dry soils. Such species in the main are cocksfoot and crested dogstail, both of which are more or less tussock-formers.

The objective in establishing such pastures should be to get a complete sward of permanent grasses almost right from the offset, and then to keep them going by top-dressing with artificial manures. A pasture of cocksfoot, crested dogstail, Timothy, and white clover is quite permanent on many of these second-class soils under fair treatment of stocking and manuring, and the mixture suggested for the long-rotation portion of the farm, considered under question (1), should give good results. The aim should be a continuous sward without any bare ground, and on the better-class short-rotation soils undoubtedly cocksfoot should form the main constituent; but just as on the steep hillsides cocksfoot must have some companion plants to fill in between its clumps, else these become raised and exposed to drying winds, so also are such companion plants necessary here. On this type of soil, undoubtedly, the boon companion grass to cocksfoot is crested dogstail, and these two grasses alone, together with white clover, may be relied on to give a permanent sward (Fig. 54). The clover element must be kept firmly in mind; other plants also may be used to help fill up between the cocksfoot, such plants as chicory, tall fescue, and tall oat-grass being worthy of mention in this respect.

(4.) *Transitional System of arriving at Permanent Pasture.*

Lastly, in the grassing of this type of country can we rely on effecting a favourable transition from a more or less short-rotational grassland pasture to some permanent grass or grasses that will take up the running after the rye-grass, &c., have run out? Can the period before ploughing up again be extended from three years to six to eight years?

The citation of a practice in vogue in the Lumsden, Mossburn, Riversdale district, Southland, will illustrate more clearly what is meant by this transition from perennial rye-grass to a permanent grass. A great deal of this country is essentially poor, short-rotational grass-

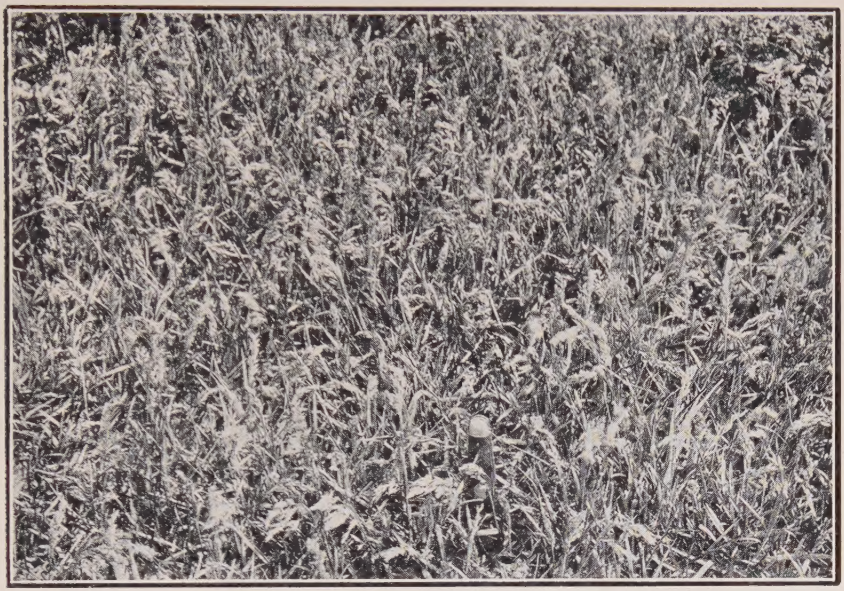

FIG. 56. POA PRATENSIS SWARD ON SHORT-ROTATION GRASSLAND SOIL, FOLLOWING ON A ROUGH BREAKING-UP OF A PADDOCK INFESTED WITH THIS GRASS

If a sward of this nature could be secured on the running-out of the rye-grass, such a cover should be preferable to one of sweet vernal, hair-grass, &c. (Compare with Fig. 57.)

FIG. 57. A TYPICAL SUCCESSION ON POOR SHORT-ROTATION SOIL PASTURE TWO YEARS OLD.

The rye-grass has become spindly, and sweet vernal is taking charge. Sweet vernal plants marked ×.

land soil, and the short-rotation pasture with perennial rye-grass as the main constituent figures largely. Quite a common practice, however, is to sow down an ordinary short-rotation mixture to which is added 3–4 lb. of Chewings fescue per acre. The rye-grass-clover element functions well for the first two years and then goes out. The Chewings fescue, which during this time is establishing, now asserts itself and takes up the running (Fig. 55), spreading out and finally occupying the ground to the exclusion of all other vegetation. While the Chewings fescue has room to spread it does so, and produces during this period quite a fair amount of feed, sufficient at least to justify leaving the paddock down, and this, it must be borne in mind, is the prime objective—that is, to extend the pasture period and to ward off profitably the need for ploughing up and resowing the area for some years. This would be necessary were the Chewings fescue not included. The fescue makes possible long-rotation pastures on really short-rotation grassland soil.

An extension of this principle is applicable to other districts with the poorer types of short-rotation grassland soils; it seems one of the most promising methods of securing long-rotation pastures. It will be obvious, of course, that the species which will succeed the rye-grass will be inferior to it, but the objective will be gained if the rye-grass can be succeeded by any grass that is superior to sweet vernal, goose-grass, hair-grass, rib-grass, &c., which plants at present take up the running on most of the soils in question. Agrostis, red-top, or "twitch" comes in also, but this, generally speaking, is on better-class soil which should be carrying a pasture of the cocksfoot-crested dogstail type.

The Chewings fescue practice on the poorer soils of Southland is particularly sound, as very often the pasture period may be culminated by a very profitable seed crop. The fescue is then easily got rid of by deep ploughing, turning the furrow completely over, with no ill-attended consequences to other phases of the rotation. If the paddock is not needed for other crops the life of the grass cover may even be further prolonged by special methods of renovation for seed-production.

In these successions which take place naturally on many of our poorer soils one is apt to despise those grasses which come in unbidden, as it were. Such grasses as twitch (*Agropyron repens*), Kentucky blue-grass (*Poa pratensis*), Colonial brown-top and Waipu brown-top (*Agrostis vulgaris*), red-top (*Agrostis alba*), and yarrow (*Achillea millefolium*) are doubtless all extremely troublesome weeds of arable land, but certainly all are superior as grassland constituents to weedy annual grasses such as hair-grass, goose-grass, English hair-grass, or sweet vernal, or to such plants as rib-grass, catsear, or field-daisy, &c.

In the cultivation of the land a tremendous amount of energy is expended to rid the soil of these "twitch" grasses, and if the land is a good first-class soil the practice is good. As regards the poor short-rotational soils now being considered, however, it seems to the writer to be a decided waste of energy where grassland is destined to occupy the major portion of the farm. Twitch-grasses respond enormously to cultivation, and if the short-rotation mixture of perennial rye-grass and red clover is sown on a twitch-infested paddock the former element will be replaced by a succession of twitch-grasses which will carry on well until such time as the soil becomes consolidated and the plants become sod-bound. Their production then rapidly falls away, and

FIG. 58. LOTUS MAJOR IN OCCUPATION AND PERSISTING ON TYPICAL SHORT-ROTATION GRASSLAND SOIL, LEVIN.

Any clover that will remain permanent on these soils is of great value.

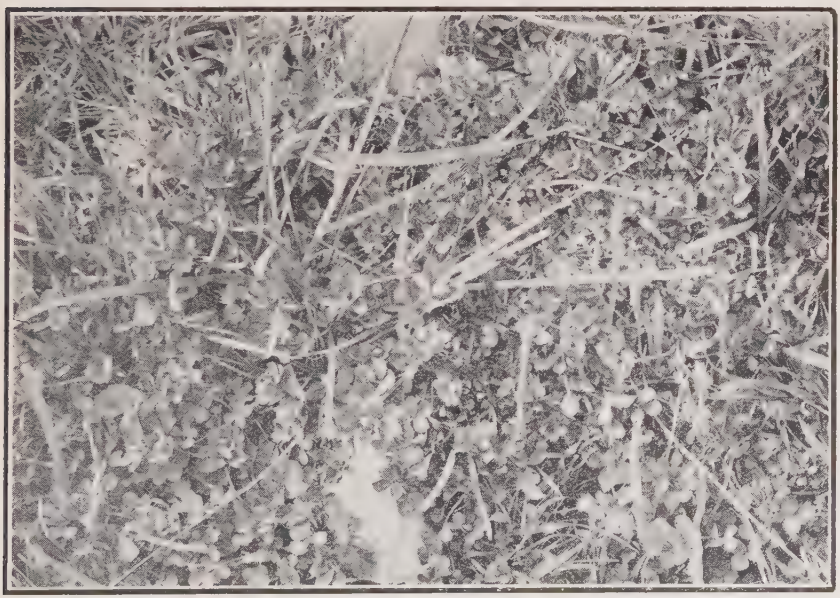

FIG. 59. ANNUAL CLOVERS, MAINLY LOTUS HISPIDUS, TOGETHER WITH SUCKLING-CLOVER, FILLING IN WELL BETWEEN THE COCKSFOOT-PLANTS, AND FUNCTIONING AS FEED-PRODUCERS AND NITRIFYING AGENTS IN THE EARLY SPRING

The sward shown is on typical short-rotation stony soil, at Levin.

renovation of such fields must be carried out. Chewings fescue in the South and paspalum in the North are two excellent examples illustrating such successions in actual practice, and there seems little doubt that more use could be made of other species to function in a similar way. The most promising are those twitch-grasses mentioned above (Figs. 56 and 57).

It must be carefully borne in mind that because a grass is a weed in certain soils such fact does not necessarily ban that plant from other classes of soil. Thus tall fescue, an unmitigated weed of fertile grass-land soils, may fill quite an important role, finally, in the grassing of many of our poorer types of drier soils.

Keeping in the Clovers.

One other feature of great importance on short-rotation soils is the difficulty experienced in keeping in the clovers. The annual clovers like suckling-clover abound everywhere, and for the short period of their growth they do a certain amount of good not only in the feed they supply, but in their nitrifying effects on the soil. The need of some clover that will remain permanent on these soils and one that will produce more feed than suckling-clover does is sorely felt. The two Lotus species, *Lotus major* (Fig. 58) and *Lotus hispidus*, are promising well in the North Island, but sufficient information outside of the Auckland District is not available to warrant recommending their general use on ploughable soils. In the North Auckland district these two species are the common clovers of the poorer class of grasslands, and their value there is beyond question. Any clovers, even if their growth is but short, are of extreme value (Fig. 59), and any palatable plant that will associate well with cocksfoot so that a closed turf may result is worth considering. On the poorest soils cocksfoot must be abandoned as the dominant grass, and reliance for permanent pasture placed on more inferior grasses, such as Chewings fescue, Waipu brown-top, &c. In fine, the nature of the soil must decide the species of grasses most likely to be successful.

Smut-infested Danthonia.—Some heads of danthonia, enlarged and black in appearance, were recently forwarded by a Hawke's Bay correspondent. The Biologist indentified the condition as a smut, *Ustilago Readeri* Syd., which is fairly common on danthonia throughout the country. There is no record of this smut being injurious to stock.

Grazing in State Forests.—This matter is dealt with in the last annual report of the State Forest Service as follows: "It is apparent that a widespread use is made of the grazing opportunities offered by State forests throughout the country, for many thousand head of cattle and sheep are fed and sheltered in these areas. During the year an investigation was begun into the economic benefits secured by pastoralists through the exercise of this privilege, and also as to the damage or otherwise done to the forests. It has been ascertained that little or no control has been exercised heretofore over stock occupation, nor has the revenue received from the use thereof been anything but negligible. It is proposed to continue the study of the effects of grazing, and to draw up a scheme of grazing-management whereby the objects of forest-perpetuation will be successfully attained, and at the same time a reasonable use of the forests for grazing purposes may be secured. It must be emphasized, however, that grazing within State forests must always be subordinate to the main objects of timber-production."

LEMON-CULTURE.

(Concluded.)

J. A. CAMPBELL, Director of the Horticulture Division, and W. H. TAYLOR, Horticulturist.

PICKING, STORING, AND MARKETING THE CROP.

IT will no doubt be readily recognized that picking, storing, and marketing represent the most important phase of lemon-culture, for not only is the care and skill required to bring these matters to a successful issue equally as great as that needed in establishing and maintaining the grove itself, but success or failure at this stage necessarily means the success or failure of the whole venture. That lemons can be successfully grown in the warmer parts of the Dominion has been amply demonstrated, but this admittedly important factor is not in itself sufficient to ensure the establishment of a successful lemon industry. There is demanded in addition a much more complete knowledge and practice of the art of storage—or what in other countries is termed "curing"—than at present obtains in New Zealand to enable the grower to carry his fruit with a minimum of loss over such periods as the exigencies of the market may demand.

Lemon-curing is a term used to indicate a certain treatment to which lemons are submitted with a view to improving the keeping-qualities of the fruit. This treatment is practically a mild form of dehydration. In reality lemons can be cured by treating them in an ordinary fruit-dryer or dehydrator. This method, however, although successful from a keeping point of view, is too severe on the fruit, causing the skin, through destruction of the natural oil in the rind, to become excessively dry and shrivelled, whereas the rind of a properly "cured" lemon should be quite smooth and soft. The curing process effects the same result so far as the removal of the moisture is concerned, but the process is much more gradual, and the desired end is effected by submitting the fruit in storage to free circulation of natural air. At the same time decay is guarded against so far as possible by dipping the fruit in a solution of sulphate of copper when washing before storage; by maintaining a low and even temperature in the storage or curing house; by the periodical picking-over and removal of decayed fruit while in storage; and last, but by no means least, by extremely careful methods of handling the fruit from the time of picking until it is packed in cases ready for market.

Although it is essential during the curing process to submit the fruit to a plentiful supply of fresh air, the humidity of the storeroom should not be allowed to fall too low, otherwise the skin of the fruit is apt to shrivel and to some extent at least take on an appearance of having been put through an ordinary dryer. A hydrodeik reading of 75 per cent. is held to be about right. An increase in humidity is effected by sprinkling the floor of the room with water, and some such plan is usually resorted to when the hydrodeik reading falls below 70.

CALIFORNIAN PRACTICE.

When in California some two years ago one of the present writers (J. A. C.) made an investigation into the citrus industry of the southern part of that State. In response to his inquiries an account of the industry was prepared and handed to him by Mr. F. A. Little, orchard-manager to the Arlington Heights Estate, Riverside. On this estate Mr. Little has under his care upward of 1,000 acres of lemon-orchards. Since this account was written some slight improvements in detail have been made, particularly in connection with storage-construction, but the matter holds good in general, and we cannot do better than here reproduce extracts from it, as follows :—

Varieties.

The varieties of lemons that are most grown in California are the Lisbon, which was originally brought from Spain; Eureka, which is a Californian production; and Villa Franca, which was brought to California from Florida. Each of these varieties has its good points, and there are growers who champion each as being the best. It just depends upon the locality and conditions under which the trees are grown. The Lisbon trees start to bear in four or five years, but the Eureka and Villa Franca start bearing when they are about three, and from then on the crop increases each year, wherever good conditions prevail. By good conditions are meant good soil, favourable locality immune from cold weather, and plenty of water, coupled with good cultivation.

Blossoming-period.

The blossoming-period of the lemon-tree is in the spring, during the months of March and April. Under ordinary circumstances it takes from seven to nine months for a lemon to grow large enough to pick, when it must be from $2\frac{1}{4}$ in. to $2\frac{3}{8}$ in. in diameter. The development of the lemon depends to some extent upon the district; for instance, near the coast lemons develop more slowly than they do inland. In other words, the trees in the interior, while they blossom at the same time as those at the coast, will have their best crop of lemons six weeks to two months earlier.

The spring bloom of the lemon-tree is not the only bloom of the year, however, for the Eureka and Villa Franca varieties bloom regularly every three months, and Eureka sometimes in between. So it is not an uncommon occurrence to have lemons in six or seven stages of development on the tree at the same time. It is a peculiar fact that the spring bloom of lemons produces, in most cases, lemons without seeds, and as this bloom comprises about 85 per cent. of the crop of the State California lemons may be considered practically seedless.

Picking.

At some seasons of the year lemons are considered ready to cut when they have a diameter of $2\frac{1}{4}$ in., while at other seasons they must have a diameter of from $2\frac{5}{16}$ in. to $2\frac{3}{8}$ in. before they are considered in condition to cut. When cutting, the workers have to use the greatest care not to injure the fruit in clipping the stem, and the best way is to cut the stem a little long first and then make a second cut closer. The picker uses a bag slung in front of his body, which holds from thirty-six to forty lemons. When the bag is full the lemons are either taken from the bag and put into a box by hand, or carefully let out of the bottom of the bag into the box. At all times great care is taken not to injure the oil-cells of the lemons. Pickers all wear gloves so as to prevent injuring the lemons with the finger-nails. The boxes of lemons are piled in the shade of the trees, so as to keep the fruit as cool as possible.

The fruit is hauled to the packing or storage house on wagons that have springs, and the topmost boxes are covered with a canvas so as to keep the hot sun from striking the fruit, as many of the groves are from two to three miles from the packing-house. Great care is also taken in unloading the fruit from the wagons. The boxes are *set* on top of each other, and are not jerked or dropped an inch or two on to the box below. They are piled six or seven high, and the persons stacking them have to watch that no lemons are above the level of the top of the box, for if any fruits were higher than the top of the box they would naturally be damaged when another box was put on the top.

Washing.

All lemons that come into the packing or storage house are washed. In our district we do not wash the lemons on account of their being dirty or because of scale pests, but simply to clean the dust off the fruit and make it perfectly clean when it is put in storage. The washing-machine used by us does not injure the lemons in the least. It is a circular washer set in a large tank filled with water. The lemons are put into the water at one end of the tank; the fruit is not dumped into the tank, but the box is set in the water and gradually submerged and the lemons float out. From this point the lemons float to the entrance of the washer, which is placed a little below the water-level, and are then sucked around for about 9 ft. in a circle through an aperture having brushes on all sides and being practically under water. The swishing of the water and contact with the soft brushes takes all the dirt out of the pores of the lemons. At the outlet of the washer there is a device with arms, these being covered with rubber or sheepskin, which lifts the lemons from the water and places them on a sorting-table on which there is a 24 in. belt moving very slowly. The table is about 30 ft. long, and on both sides there are men who take the lemons from it and lay them in boxes. All these men wear gloves, as the nails are about the worst things for injuring the texture of lemons and causing decay.

In taking the lemons from the table we sort them according to colour—that is, all the dark-green lemons are put in one box, all the silver-green in another, and the yellow in another. The lemons are *laid* in the boxes. In fact, we at all times aim to handle the lemons as carefully as though they were eggs. We sort for colour on account of the keeping-qualities of the different-coloured lemons. The dark-green and silver-green fruits are the best for keeping, while the yellow or tree-coloured fruit does not keep so well, for it has not the life in it that the green fruit has. It is bad policy to pack any of these yellow lemons in with the others, for it is sure to cause trouble sooner or later, the same conditions not suiting all lemons. With one washer we wash probably 1,000 to 1,200 boxes in ten hours, this representing about two and a quarter railway carloads.

Storing.

From the washer the fruit is trucked away to a place in the storage house, and stacked in lots containing about a carload. It is placed so that after the fruit dries thoroughly a canvas tent can be dropped over the pile, and it can then be kept at a uniform temperature. When each pile or tent is started it is given a number, and a complete record is kept of that tent—namely, when it was delivered, when it was stacked there, and then, from time to time, when it was inspected and ventilated, also how the fruit was keeping, and anything else pertaining to that particular tent. In storing lemons on a large scale great care has to be taken to have the work so systematized that track of the fruit can be kept. We had at one time this season 160 carloads of lemons on hand at once, and we could get at any carload without disturbing another stack.

Colouring.

In the autumn practically all the lemons are delivered to the packing-house perfectly green. We aim to pick the lemons at that period of the year so that they will pack out 300's, as they are then more mature and juicy than if picked smaller. From experience we know that it is useless to send green lemons to the East American markets, so it is best for us at this end to colour them artificially. This is done by putting the lemons in a colouring-room, which can be made almost airtight if required. In this room are placed blue-flame coal-oil stoves, on which are kept pails of water all the time. The lemons are also thoroughly wetted with a hose. It is found that in the course of about five days by keeping the temperature at 90° F. the lemons have taken on a good colour. We know from experience that these lemons carry well, keep well, and have as much juice in them as if they had been coloured naturally. The colouring which has been done to them has only improved their marketing-qualities. If one has no colouring-rooms the colouring can be done by placing the lemons under a canvas tent of two thicknesses, and keeping it thoroughly wet, thus preventing the heat from escaping. We find that it takes only one day longer to colour lemons this way, but the rooms are the best. The only difference one can detect between the lemons coloured artificially and those coloured naturally is that the shield at the stem end of the fruit drops off after it has been coloured artificially. As far as we know, however, this does not affect the keeping-quality, though it might do so if the lemons were held in storage at this end for four or five months after being coloured artificially.

Temperature and Storage Houses.

We aim to keep the temperature in the storage house as low as possible by ventilation. In order to obtain the best results it is necessary to have a night man, so that the house can be ventilated at any time. Sometimes the house is not ventilated until 10 or 11 o'clock at night, for the reason that the air inside the house is cooler than the air outside. We have thermometers both inside and out, so that a reliable comparison can be made at any time.

The best storage facilities in California are sub-basements. It is found that the temperature can be kept more even by this means than with any other method. On a hot day the temperature in a sub-basement will be from 35° to 40° lower than outside. One of our storage houses is 203 ft. long by 103 ft. wide, and is a house within a house. In warm weather the difference outside and in is sometimes as much as 40°. We are situated in a valley some sixty miles from the coast, and handling lemons in the interior is somewhat different from handling them near the coast. With us it is necessary to have first-class storing-facilities.

Resorting.

Lemons are generally looked over about three weeks or a month after they have been delivered. This is done so as to eliminate those fruits that show up weak or have been accidently injured in the handling. The men who look over the lemons all wear gloves. We find that the better grades of lemons hold up well, so they do not have to be gone over more than once. We have shipped in June lemons that were picked and delivered in October, eight months previously. These lemons were looked over only once, and they were put down in the basement perfectly green. Tree-coloured fruit, however, and such lemons as are put into the standard grade have to be looked over more frequently, which is on account of being more or less marred by the branches; then, again, the yellow fruit has got ripe on the trees and has not the life in it that green fruit has.

The ideal condition in which to have lemons is for them to be firm with a green stem. When they are like that they will carry under ventilation to any market in the country if every care is used in packing.

Grading.

The grading of the lemons is done differently in various districts. The aim is to put up the best grade of lemons that will contain from 60 to 65 per cent. of the fruit for a first-grade, probably 25 per cent. as a second-grade, and the remaining 10 to 15 per cent. as standards. In that way straight carloads of the first-grade can be shipped at any time. Some shippers have been grading their lemons so that the first-grade comprised only about 35 per cent of the fruit, but the drawback then is that all the trade want these lemons and enough cannot be got of them. The former plan is by far the best. We at this end realize that the choice and standard lemons are just as good as the fancy so far as the contents go, for they are all grown on the same tree, perhaps on the same branch and in the same cluster, and the lemon is put into the choice or standard grade simply because its skin is marred by a leaf or twig.

In grading the fruit the men look at practically every lemon and decide to what grade it belongs, and the fruit is laid in its proper box. They will not look over more than about eight boxes an hour on an average. After the fruit has been graded it is trucked to the packers, who pack it in boxes with as much care as has been exercised in all the former stages.

Packing.

Every packer wears a glove on the hand which picks up the lemons; with the other hand he takes the paper. Each lemon is wrapped in a separate sheet. The idea in packing is to make the pack tight, to use uniformly sized lemons, and to always put the stem of the lemon either next the side or else toward the centre of the box. The last layer should protrude above the top of the box about half the diameter of the lemons, then when the cover is put on no injury is done to the fruit. Care is taken by the pressman when putting on the covers. After the cover is put on a wire is put around the centre of the box, which strengthens the cover and keeps the lemons from being pillaged when the boxes are forwarded out by the distributing trade. Care is also taken when trucking the fruit into the cars not to jolt boxes against anything. In loading cars the usual way is to put 312 boxes in a car in six straight rows, thus giving straight aisles for the air to pass through.

SOME STANDARD VARIETIES OF LEMONS (GROWN AT TAURANGA HORTICULTURAL STATION).

1. Lisbon. 2. Eureka. 3. Crisp's. 4. Villa Franca. 5. Section of Eureka. 6. Ditto cured. 7. Section of Lisbon. 8. Ditto cured.

SUMMARY.

Summarizing the matter for New Zealand growers the following points may be set out :—

(1.) Lemons should not necessarily be held on the tree until ripe, but in preference should be picked green when they reach a size of 2¼ in. to 2½ in.

(2.) The picker should wear gloves in order to prevent finger-nail injury of the fruit. Picking should be done by means of a specially designed sharp shears, and the stems of the fruit should be cut in such a way as to avoid injuring the " button " (at the same time avoiding the danger of injuring other fruit) by leaving no stem-spike.

(3.) The fruit should be carefully picked into a suitable picking-bag, and from thence equally carefully into the orchard picking-box, which should be well made and perfectly smooth on the inside.

(4.) Picking-boxes when full should be handled as carefully as possible, and should be conveyed to the packing-house in spring vehicles, the load being in accordance with the strength of the springs.

(5.) In the packing-shed the fruit should be washed in a solution of bluestone and soda, and then graded by colour—" yellow," " silver," and " green."

(6.) The green fruit should be artificially coloured by means of petroleum-fumes, and, together with the silver grade, be submitted to a process of curing. The yellow grade should be packed and disposed of as quickly as possible.

(7.) The curing-house should be of such construction as will maintain an even temperature, be ventilated adequately, and in such a manner as to conveniently admit large supplies of air when required.

(8.) Standard grading should be adopted, and such grading and sizing be done by hand.

Marketing.

There is no doubt that the handling of the lemon crop is a business which urgently calls for co-operation, as it is by this means only that sufficient fruit is likely to be assembled under one control to enable proper methods to be put into practice. While this is a matter for growers generally to decide, it is very evident that individual effort alone will be a long time in raising the New Zealand lemon industry to the position it might otherwise readily attain. In this connection it is satisfactory to note the recent movement toward centralization which has commenced in the Auckland and Bay of Plenty districts mainly under the supervision of Mr. Harvey Becroft, who has recently returned from California, where he spent some time in investigating the citrus industry of that State. The formation of the Tauranga Citrus Growers' Association, and the evident determination of the growers of that district to centralize and improve their packing, storing, and marketing methods, marks the first definite step in this direction yet made by the lemon-growers of the Dominion, and it is to be sincerely hoped that this and similar projects which are likely to materialize will meet with every success.

SHEEP MAGGOT-FLY CONTROL BY INSECT PARASITES.

THE INTRODUCTION OF NASONIA BREVICORNIS.

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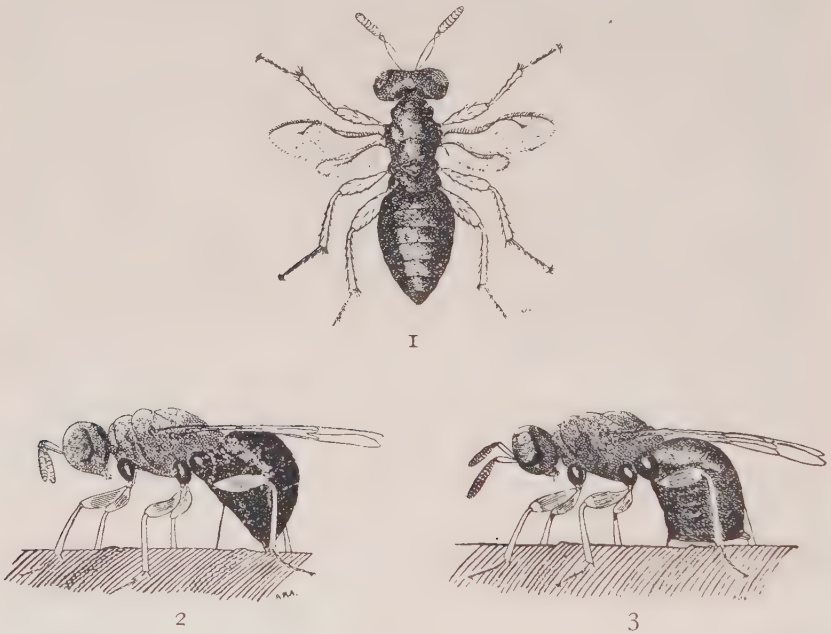
SINCE the first account of the investigation into the sheep maggot-fly problem in New Zealand was published in the *Journal* for June, 1921, the work has been considerably extended, and the information collected will form the subject of a report to be given after the close of the present fly season.

As mentioned in last year's article on this matter, the golden-haired blow-fly (*Pollenia stygia*) and the greenbottle (*Lucilia sericata*) were the most active in wool-blowing, and as the control of maggot-flies by means of insect parasites was receiving considerable attention in Britain and Australia an endeavour was to be made to introduce and establish certain of these parasites in New Zealand. On 3rd March a large consignment of pupæ infested by one of these parasites, *Nasonia brevicornis* Ashm., was received from Mr. W. W. Froggatt, F.E.S., &c., New South Wales Government Entomologist. Since the adult parasite had hatched out in large numbers during transit they were immediately distributed to five localities where the sheep maggot-flies are particularly prevalent—namely, Timaru, North Canterbury, Blenheim, Hawke's Bay, and Whangarei—a number being also retained at this Laboratory and liberated among pupating blow-fly larvæ which are being bred out in captivity.

Nasonia brevicornis occurs in Australia, Britain, North America, Chile, and India, and is a minute greenish-and-black-coloured chalcid wasp, with yellowish or brownish legs. The females measured from $\frac{1}{25}$ in. to almost $\frac{2}{25}$ in. in length, and the wings are well developed. The males (Fig. 1) are smaller, and their wings considerably reduced in size. A great deal of work has been done on the life-history and habits of this parasite by Froggatt, Altson, Girault, Saunders, and others, and it is from the observations of these authors that the following notes are taken. *N. brevicornis* parasitizes the pupæ of several species of maggot-flies, among them being the golden-haired blow-fly, the greenbottle, the European bluebottle (*Calliphora erythrocephala*), the Australian greenbottle (*Pycnosoma rufifacies*), and the common house-fly (*Musca domestica*), all of which are well established in New Zealand.

A single female parasite lays several eggs within a single maggot-fly pupa, and as many as 148 adults (Altson) have been reared from one fly-pupa. With regard to egg-laying Altson states that the pupæ are parasitized some twenty-four to seventy-two hours after transforming from the maggot. The female *Nasonia* apparently discriminates between healthy and unhealthy maggot-fly pupæ, and will not lay her eggs in those that are empty or contain malformed developing maggot-flies. A suitable pupa having been selected she places the point of the ovipositor in position (Fig. 2), puncturing the skin of the pupa; as the ovipositor is pushed home the abdomen is lowered on to the pupa (Fig. 3), and the eggs are deposited within. This being accomplished

the ovipositor is withdrawn, when the *Nasonia* makes a meal of the minute drop of fluid exuded from the wound on the pupa-skin. Although the males are short-lived, the females, if plenty of food and maggot-fly pupæ are available, will live as long as six weeks. *N. brevicornis* passes the winter in the larval stage within its host pupa and the adult emerges in the spring. The females, although their wings are well developed, do not fly to any great extent, while the males are incapable of flight. The length of the life-cycle from egg to adult



NASONIA BREVICORNIS.

Fig. 1. Male. Fig. 2. Female ovipositing—first position. Fig. 3. Female ovipositing—second position. Greatly magnified. After Altson.

varies greatly under different climatic conditions. Altson found that under an average temperature of 68° F. the length of life-cycle was three weeks; Froggatt gives about a fortnight as the period in Australia.

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LIMING AND MANURIAL TRIALS WITH RAPE AT MARTINBOROUGH.

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THROUGHOUT the Wairarapa district the natural occurrence of workable deposits of limestone is frequent. In the south-eastern portion at Dyerville, about seven miles from Martinborough Township, there is a deposit of fragmented shell which is at present being worked by a co-operative farmers' lime company. Up to the present time the business done has not warranted the installation of a crushing plant, so that the question naturally arises in the mind of the local farmer as to whether it is a better commercial proposition to use Martinborough lime, which may be obtained at the quarry, screened but uncrushed, at 12s. per ton, or Mauriceville lime, which has to be carted eleven miles from Featherston, the nearest railway-station. The estimated cost of Martinborough lime on the soil of a farm in the vicinity of the township is £1 5s. per ton, while that of Mauriceville crushed limestone is £2 10s. per ton, or about twice the price of the local product. The chemical analysis of Martinborough lime shows from 92 to 95 per cent. carbonate of lime, or much the same as that of Mauriceville, while a mechanical analysis shows that in a given weight of it about 40 per cent. is as fine as the crushed limestone.

Prior to our experimentation a number of farmers claimed to have achieved satisfactory results with the local lime, but in order to settle the doubt which seemed to exist in a good many minds as to its relative efficiency the Department undertook to conduct three experiments for testing the Martinborough lime against that from Mauriceville and Napier. Two of these experiments are concerned with the liming of pastures, a paddock owned by Mr. W. A. Iorns being limed on 6th July, and one belonging to Mr. R. Frater on 15th August, 1921. At time of writing, apart from a marked increase in the clover content of the limed plots, these paddocks show little difference in growth, but taking into consideration the long spell of dry weather which succeeded the liming they have hardly had time to show further results. The third experiment, with which this article is mainly concerned, was conducted on Mr. M. McLeod's property. An analysis of this soil for lime-requirement, made by the Department's Chemist, showed a deficiency of 2 tons 2 cwt. per acre.

As climatic conditions always exercise a great influence in the case of both liming and manurial trials the Martinborough weather report given by the Government Meteorologist for the year ending 31st December, 1921, may be quoted as follows :—

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Rainfall (Inches).												
2·41	0·96	0·44	0·90	1·52	2·23	3·18	2·14	2·18	4·93	2·26	6·37	29·52
Number of Wet Days.												
12	7	7	11	14	17	18	16	10	17	14	9	152

The mean annual rainfall for the past twenty years is 29·50 in.

The paddock, prior to our taking it over, had been down in grass which had run out to fiorin. About 9½ acres were brought under cultivation, 8 acres being actually employed for experimental purposes. The land was ploughed late in June, and was limed (in strips at right angles to the road) on 5th July, it being our intention to manure it at the time of sowing, in transverse direction to the liming. Proceeding from left to right the plan of our liming operation was as follows, each plot being 1 acre in area: (1) Control (no lime); (2) 3 tons Martinborough lime; (3) 2 tons Mauriceville lime; (4) control (no lime); (5) 1½ tons Martinborough lime; (6) 1 ton Mauriceville lime; (7) control (no lime); (8) ½ ton Napier burnt lime.

It will be noticed that the Martinborough and Mauriceville limes have been applied in the ratio of 3 to 2. It was thought that when applied in this ratio due allowance would be made for the different degrees of fineness, seeing that the Martinborough product was uncrushed. The paddock was disked, fallowed for two months, then disked again, cultivated twice, and tine-harrowed twice. Sowing, which had to be delayed for three weeks on account of weather conditions, took place on 15th November, 1921, when seed was drilled at the rate of 3¾ lb. of broad-leafed Essex rape per acre.

The manurial trial plots, which crossed the limed plots at right angles, comprised the following: (1) Control (no manure); (2) 2 cwt. New Ephos per acre; (3, 4, and 5) three consecutive acre plots, each treated with ground Nauru phosphate rock at the rate of 2 cwt. per acre; (6 and 7) two consecutive acre plots, each treated with 2 cwt. per acre of Gear superphosphate; (8) 1 acre treated with 2 cwt. Gear rape-manure.

On 16th and 17th January last weighings were taken from the sixty-four plots so formed, with the following results, expressed in tons per acre:—

Manure.	Lime.							
	Control (no Lime).	3 Tons Martinborough.	2 Tons Mauriceville.	Control (no Lime).	1½ Tons Martinborough.	1 Ton Mauriceville.	Control (no Lime).	½ Ton Napier Burnt.
Control	7·8	14·5	16·6	8·8	12·8	13·6	5·9	8·1
New Ephos	20·2	22·3	24·1	23·3	23·7	24·2	17·6	17·0
Nauru rock	21·3	25·3	18·6	24·1	24·2	17·8	20·3	17·3
Nauru rock	20·6	17·3	21·1	21·1	19·4	26·1	20·6	21·4
Nauru rock	18·3	20·0	23·6	19·5	22·7	19·8	27·3	19·4
Gear super	19·5	23·8	20·9	17·3	22·0	21·1	17·8	24·7
Gear super	18·4	21·1	22·2	21·6	21·3	21·1	16·9	23·6
Gear rape	23·3	21·4	24·4	20·5	26·9	20·2	20·2	16·4

It must be borne in mind that the ultimate aim of this experiment is to test the effect of the various applications of lime and manure on the grass pasture which is to follow the present rape crop. The crop is now being fed off with sheep, and next spring the paddock will be sown with rape and grass so that the experiment may be further extended.

At a well-attended field-day held on the plots on 26th January last much interest was evinced by the local farmers in the control plot at the north end of the paddock. This plot received no manurial treatment, and so afforded an excellent opportunity for judging the effects of the various applications of lime. The yields were at the following rates: Control (no lime), 7·8 tons; 3 tons Martinborough, 14·5 tons; 2 tons Mauriceville, 16·6 tons; control (no lime), 8·8 tons; 1½ tons Martinborough, 12·8 tons; 1 ton Mauriceville, 13·6 tons; control (no lime), 5·9 tons; ½ ton burnt lime, 8·1 tons.

As will be seen from these results, even if such a high margin as 10 per cent. is allowed for experimental error (some authorities consider a 7-per-cent. margin ample), the control plots are in every case very much below the limed plots in yield. The average yield from the control plots was 7·5 tons per acre, while that from the limed plots was 13·1 tons, a difference of 5·6 tons, or approximately 75 per cent.

GENERAL VIEW OF THE TEST AREA ON MR. MCLEOD'S FARM, MARTINBOROUGH.
Feeding off with sheep after taking weights of rape.
[*J. M. Smith, photo.*

Before making an attempt to draw a comparison between the various manurial dressings themselves it may be instructive to inquire as to what effect the combination of each manure with lime has produced. On referring once more to the tabulated schedule it is found that in the case of New Ephos, a manure which the manufacturers claim is quicker in action than superphosphate, the average yield from the unlimed plots is at the rate of 20·4 tons per acre, while the mean yield from the limed plots is 22·3 tons, a difference of 1·9 tons, or 9·3 per cent. If the 7-per-cent. standard of marginal error is adopted it may be claimed that the use of New Ephos after lime has been superior to the use of New Ephos alone. If, however, it is decided to allow a margin of 10 per cent., it may be said that although this season's results provide no definite data they yet serve to indicate that Ephos has "probably" given better results after lime. It may be stated that an analysis of New Ephos made by the Department's Chemist reveals no chemical difference between it and the old Ephos.

The average yields from the 3 acres treated with Nauru ground rock phosphate were (*a*) on the control plots, nearly 21·5 tons per acre, and (*b*) on the limed plots, 20·9 tons per acre, giving a difference of 0·6 ton, or about 2·3 per cent., an entirely negligible margin.

In the case of Gear superphosphate the rates of yield were (*a*) on the limed plots, 22·2 tons per acre, and (*b*) on the unlimed, 18·0 tons per acre, giving a difference of 3·0 tons per acre, or approximately 19·4 per cent. This is, of course, quite a marked difference, and may be regarded as quite a definite result. The appearance of the crop bore out these results, the unlimed portion having a much paler appearance in the leaf than the limed portion, while in places the difference in growth was evident, even to a casual observer. It may here be pointed out that Gear superphosphate must not be regarded as an ordinary superphosphate, since it contains, in addition to 11·4 per cent. water-soluble phosphate and 4·6 per cent. insoluble phosphoric anhydride, 1·2 per cent. of insoluble nitrogen.

Gear rape-manure seems, from the yields, to show practically no benefit this season from its use with lime, but, as was the case with Gear super, there was a marked difference in the colour of the leaves, a much darker green marking the limed areas.

So far as the relative efficiencies of Martinborough, Mauriceville, and Napier (burnt) limes are concerned some gauge as to their action without manures may first of all be got by referring to the manurial control areas. As previously stated, the average yield from the unlimed plots was at the rate of 7·5 tons per acre, that from the plots treated with Martinborough lime 13·7 tons, Mauriceville lime 15·1 tons, and Napier burnt lime 8·1 tons. The low yield on the last plot was undoubtedly due to irregular soil conditions. Between the Mauriceville and Martinborough averages there is found a difference in yield of 1·4 tons per acre, or a little over 10 per cent., so that the weight of evidence is for this season in favour of Mauriceville lime. If two separate comparisons are made the figures in the first instance, where the test is 3 tons of Martinborough lime against 2 tons of Mauriceville, are 14·5 tons against 10·6 tons, a difference of 2·1 tons, or approximately 14½ per cent. Where 1½ tons of Martinborough are tried against 1 ton of Mauriceville the result is a yield of 12·8 tons against one of 13·6 tons, again a difference in favour of the Mauriceville product, this time to the extent of 0·8 ton, or 6·2 per cent., a fairly negligible difference, however. Taking the average control plot into account it is found that the average Mauriceville plot exceeds it in yield by 7·0 tons, or slightly over 100 per cent., while the Martinborough plot, with an excess of 6·2 tons, shows a margin over the control of nearly 83 per cent. From these results, when the relative costs given are taken into consideration, it becomes evident that it is well worth while for the local farmer to use the lime of his own district.

On the plot treated with New Ephos the average yield from the portion on which Martinborough lime had been applied was 23 tons per acre, and from that receiving an application of Mauriceville lime 24·2 tons per acre, a difference of 1·2 tons, or of 5·2 per cent. Where the 3-tons to 2-tons ratio of application of the two limes has been followed the yields are 24·1 tons in the Mauriceville portion and 22·3 tons in the Martinborough, a difference of 1·8 tons, or over 8 per cent. In the case of the 1½-tons to 1-ton plots the figures are 24·2 tons for Mauriceville lime and 23·7 tons for the Martinborough product, a difference of 0·5 ton, or only 2·1 per cent. The average for the unlimed plots treated with New Ephos was 20·4 tons per acre, so that the Martinborough (23 tons) and the Mauriceville (24·2 tons) yields show

respectively differences of 2·6 tons and 3·8 tons, or 12·2 per cent. and 18·6 per cent., with a margin between the two varieties of lime of 6·4 per cent. in favour of the Mauriceville article in combination with New Ephos. The plot with Napier burnt lime again gave a lower yield (17 tons), owing to poor soil conditions.

Working on similar lines it is found that in the case of Nauru ground rock phosphate the results are as follows: Average of portions receiving Martinborough lime and Nauru rock phosphate, 21·5 tons; average for Mauriceville lime and Nauru rock phosphate, 21·2 tons, showing the negligible difference of 0·3 ton, or 1 per cent. Again, comparing plots receiving the different limes in the 3-tons to 2-tons ratio, the average yields are found to be 20·9 tons per acre for the Martinborough and 21·1 tons for the Mauriceville lime, a difference of 0·2 ton, or even

SHOWING EFFECT OF LIME ON GROWTH OF RAPE IN THE TESTS.
On left, unlimed ground; on right, limed.
[*J. M. Smith, photo.*

less than 1 per cent. Comparing Martinborough and Mauriceville limes respectively in combination with Nauru rock phosphate with the unlimed but manured plots the average control plot is found to yield 21·2 tons, the average Martinborough lime and Nauru rock plot 21·5 tons, the average Mauriceville lime and Nauru rock plot 21·2 tons, and the average Napier burnt lime and Nauru rock plot 19·4 tons. From these results it will readily be seen that no conclusion, either as to the combination of Nauru rock phosphate with lime generally or with any particular variety of lime, can be drawn.

On plots treated with Gear superphosphate the Martinborough lime gave an average yield of 22·1 tons, while the average from the Mauriceville lime plots was 21·3 tons, a difference of 0·8 ton, or less than 4 per cent. Comparing plots receiving the different limes in the 3-tons to 2-tons ratio, those receiving Martinborough lime yielded 22·5 tons,

while the Mauriceville lime areas gave 21·5 tons (nearly), a difference of 0·9 ton, or nearly 4·2 per cent. In the 1½-tons to 1-ton plots the Martinborough lime gave 21·7 tons, and the Mauriceville 21·1 tons, the difference being only 0·6 ton, or less than 3 per cent. As previously seen, the use of lime with Gear super has been advantageous this season. Since the average on plots treated with super without lime was 21·3 tons, and the plots receiving a combination of super with Martinborough and Mauriceville limes respectively gave 22·1 and 21·3 tons, it was evidently immaterial which of these two limes was used with the manure. Napier burnt lime, however, when used with super gave 23·6 tons, an advantage of 1·5 tons over the Martinborough and 2·3 tons over the Mauriceville limes, both advantages of over 10 per cent. In this case the burnt lime enjoyed average soil conditions.

The Gear rape-manure used with Martinborough lime gives an average of 24·2 tons (nearly), while the Mauriceville combination gives an average of 22·3 tons, showing a difference of 1·9 tons, or of 8·5 per cent., in favour of Martinborough lime used with rape-manure. Taking the 3 to 2 ratio of lime application, the rape-manure and Martinborough yield is 21·4 tons, and the rape-manure and Mauriceville 24·4 tons, a difference of 3 tons in favour of Mauriceville. On the 1½ to 1 ton limed plots there is a difference of 6·7 tons in favour of Martinborough. These anomalies are probably due to soil irregularities, which are evident in places on these plots. It will be seen that the Napier burnt lime has again suffered through being on a light corner of the paddock, the yield when it was used with Gear rape-manure being only 16·4 tons per acre. Used with Gear rape-manure the average yield of Martinborough lime (24·2 tons) and that of Mauriceville (22·3 tons) show over the unlimed plot (average 21·3 tons) differences of 2·9 tons and 1 ton respectively, or 13·6 per cent. and 4·6 per cent., the latter difference being quite negligible.

When the manurial trials are compared in so far as the average yields from the various plots are concerned the following results are obtained: Control (no manure), 11 tons per acre; New Ephos, 21·6 tons; Nauru ground rock phosphate, 21 tons; Gear superphosphate, 20·8 tons; Gear rape-manure, 21·7 tons. It will thus be seen that while all manured plots have yielded between 90 and 100 per cent. more than the unmanured control areas, there is no difference on which we could rely among the manurial plots themselves.

Summarizing the results of this season's work it may be said the following points have been clearly demonstrated: (1) That lime has beneficial effects; (2) that while Mauriceville lime acts more quickly the Martinborough lime acts well and is the more economical proposition for local farmers; (3) that Gear superphosphate and lime give better results than Gear superphosphate alone; (4) that there are strong indications that New Ephos also works better with lime.

It must be borne in mind that had the latter part of the season been drier it is probable that several of the manures would have worked more slowly. It will be impossible to draw anything even approaching a definite conclusion with regard to the action of Nauru ground rock phosphate in this experiment until another twelve months have elapsed. It will also be interesting to note which lime—Mauriceville, Napier, or Martinborough—persists longest in its effect so far as the pasture to be laid down next season is concerned.

A POVERTY BAY FARMING CALENDAR.

A. J. FAULKNER, "Wairakaia," Muriwai.

[These jottings have been contributed by request, with the idea of affording some practical hints to inexperienced settlers. Although defined as a Poverty Bay calendar, the routine described applies more or less generally to the east coast from Cape Palliser to the Bay of Plenty. Mr. Faulkner's station, "Wairakaia," situated some sixteen miles southward of Gisborne, is typical of the class of farming and country dealt with, the larger part consisting of well-grassed hills carrying sheep and cattle, but also comprising a considerable area of flats available for cropping. Dairying, which is steadily extending in Poverty Bay and at other points of the coastal region, is not included in the scope of the present notes.—EDITOR.]

January.—Lambs should be all weaned by the end of the first week in January, if this has not been done in Christmas week. It is not advisable to wean straight on to rape; only forward lambs should be put on that crop, and care also taken that they have water. If there is any chance of their scalding, shift them every second day on to clean grass. Lambs should be dosed if showing signs of worms, and, where practicable, shifted every seven days to fresh feed. This applies right on into May. Dip and crutch woolly lambs. Ewes can be used to clean up any dirty paddocks. Take out all weak or small lambs, and put them on to sweet feed. If blow-flies are bad, late ram lambs are safer castrated the same way as calves, slitting the tough covering of the testicle and removing the inner part only. Make certain that the rams' feet are in good order. Swede turnips should be sown by the first week of the month, and weeding of other root-crops about finished. Finish the burning-off of any bush, scrub, or manuka where clearing is being carried out, and sow bush-burns as soon as possible. Harvesting operations will be completed, and grain crops and hay saved for seed or winter feed will be in stack by the end of the month.

February.—The main dipping is carried out this month. A good plan where the water is hard is to add 7 lb. washing-soda to 100 gallons water when filling the dip, adding 2 lb. per 100 gallons water as dipping is proceeded with. Do not use dip of full strength when dipping rams or Down sheep of either sex, as there is a danger of scalding. In the case of rams their blood is usually heated, partly owing to the feed and partly owing to the approaching tupping season; with Down breeds the wool is very dense and holds the dip. Cull the ewes, aiming for a certain type, remembering that only a first-class ewe is profitable. Put out Down rams in the first or second week, and Romney rams towards the end of the month. Take care that the rams are first-class, inferior rams being dear at any price. The bulls should now be changed, rounding up the cows every couple of weeks. Ploughing for autumn crops can be commenced.

March.—By the end of the first week of March the rams will be all out. The ewes should be run with the rams in big mobs, shifting frequently from paddock to paddock. Round up ewes to yards, or shift into a fresh paddock every seven days. The bulls should now be taken out. When the ground is ready and weather favourable sow grass, soft turnips, barley, oats, &c., for winter feed. By the end

of the second week autumn-sown lucerne should be all in. It is necessary to have the ground in good heart and well worked for lucerne, and expenditure on liming, manuring, and inoculation is money well spent.

April.—During this month the ewes should be rounded up to yards or shifted into fresh paddocks every seven days. Take out the rams at the end of the month, and if necessary treat them against foot-rot. Remember to dose lambs when showing signs of worms, and if possible shift them on to sweet feed every seven days. Sowing of autumn crops should be completed by the middle of the month.

May.—It will now be about time to get down to winter carrying. All fattening lambs, sheep, and cattle should be off by the end of the month. Crutch lambs and ewes if this has not already been done. Keep an eye on the breeding-ewes, and see that they have good feed. Take care not to feed off green oats or barley too hard. The calves should now be weaned, a good plan being to put the cows on one side of the fence and the calves on the other. In a week's time the calves will have settled down and can be shifted on to a paddock of good sweet feed. Arrange winter stocking of cattle so that most of the rough feed will be cleared up by spring. Wet days can be profitably employed to overhaul implements, giving wood and iron work two coats of red-lead and boiled oil; paint swingletrees, and oil harness. Hames and shearing-machine shafting look well painted with aluminium paint. Clean up stables, wool-shed, &c. This is the best month for commencing tree-planting. If the planting is for future posts, no better investment can be made.

June.—Sheep and cattle should now be put on to their winter blocks, keeping any animals not up to standard in a separate paddock. Probably not half the number of landholders have the correct acreage of their various paddocks; this is a very necessary guide as to the amount of stock to be wintered on each paddock. Fence turnips into breaks, and make wire-netting racks for hay fed in the paddocks, if any has been saved. Judgment should be used in feeding off green cereal crops. A certain amount of hay, mangolds, &c., will be fed to stock this month. Wean any foals, and try to do them well through the winter. Repairing of fences and clearing of drains will be timely work.

July.—A careful eye should be kept on sheep and cattle during this winter month. Ploughing may be started for spring crops. Filling in gateways, tarring of gates and yard-fencing, and trimming of hedges are other seasonable jobs. Keep busy on wet days overhauling and cleaning machinery. All tree-planting should be completed by the end of the month.

August.—The lambing season will now have commenced. When possible, walk or cut out ewes with early lambs and dock the lambs. Keep a watchful eye on the sheep, and if the hoggets are crowding in corners shift them out. If the cattle are short of feed try and put the worst-conditioned animals on to better pasture. Keep the plough moving, but do not undertake more work than the team or teams can do properly. Autumn-sown oats, barley, and grass are best in these districts, but given favourable weather they may be sown this month also. When the weather is suitable run a chain or grass harrow over the grass-paddocks to scatter the stock-droppings.

September.—The main docking and marking will be done this month, dry ewes taken out, and six-tooths and over probably sold as fats. Docking should not be done in sheepyards; temporary yards on a clean piece of grassland are readily put up and are safer. In addition to the ordinary mark an age-mark will be found very useful. If English grasses are running out in different parts of the farm try shutting up a paddock at this time each year to go to seed, the paddock to be cleaned up and seed tramped in by cattle later on. Half-stocking a paddock is not good practice, as stock eat the sweetest grasses and leave the worst to seed. Continue ploughing operations, and start getting the ground worked down ready for sowing.

October.—Shearing of dry sheep commences any time this month. Wet ewes will require watching carefully, and any hard-grazed paddocks eased up if there is any better feed to put the ewes on to. Cattle will be rounded up, and calves earmarked, age-marked, &c. Mares heavy in foal should be put on to flat paddocks with no drains or creeks, and looked at morning and evening. From the middle of the month crops such as peas, beans, lucerne, rape, &c., will be sown. Bear in mind that one acre put in properly is worth three acres carelessly done. It is a good plan to damp rape or turnip seed with turpentine before sowing, this treatment keeping the fly away to a great extent. Strips ploughed previously on the hills for gum plantations can now be sown broadcast, the gum-seed being tramped in with sheep. Cut variegated thistle where this weed is prevalent; odd plants can be dealt with when going round the sheep.

November.—Shearing of wet ewes will start this month. When piripiri ("biddy-biddy") is in the paddocks the sooner shearing is finished the better. Fattening bullocks and cows will be moved on to better feed. Bulls should be put out towards the end of the month. Usually all dry cows are sold, but if any of these are put to the bull they are better washed out with corrosive sublimate tabloids, one tabloid (8·75 grains) to 2 pints of warm water. Bulls can be washed out with a common syringe, holding the sheath with the left hand; fill the sheath with solution, and work it towards the testicles with the right hand. When manuka is thin and unlikely to carry a hot fire this is the best time to start cutting it, as it will be in flower. Poison blackberry, and cut all variegated thistle. Crops such as maize, pumpkins, and mangolds will require final attention early in the month as regards cleaning and thinning.

December.—This month usually sees shearing finished and the first draft of fat lambs sent away to the freezing-works. Weaning of lambs can start with the third week. With sweet feed to put the lambs on to they are better weaned than tugging away at a ewe that in many cases has no milk. Early weaning is advisable, especially in dry seasons, as if done in good time a fair growth of feed may be secured for the lambs. Late weaning means patchy paddocks and bare sheep-camps. Harvesting will now be in full swing, and the time spent in overhauling machinery on wet winter days will be well repaid.

NOTE REGARDING RABBITS.—There are practically no rabbits in the East Coast district north of the Mohaka River. In Hawke's Bay (south of the Mohaka) it is usual for two or more landholders to share the cost

of a rabbiter, who rides from place to place. In places where rabbits are numerous a block of land should be crushed out with sheep in February, and phosphorized pollard or oats laid in March and April, lines being run with a plough or small holes made with a spade. It is necessary to have the feed as short as possible. Rain will spoil the poison.

THE NOSEMA DISEASE OF BEES.

R. WATERS, Biological Laboratory, Wellington.

THE stomach of the bee has an internal cellular lining of what are known as epithelial cells. These cells are sometimes tenanted by minute ovoid bodies, the spores of an organism named *Nosema apis* Zan. The organism is of the simplest kind, consisting as it does of but a single cell, and is therefore grouped with the lowest animal forms—the Protozoa. It has been observed in Britain, Denmark, Germany, Switzerland, Canada, the United States, and Australia. Now it is to be recorded as present in New Zealand.

NOSEMA APIS.

(*a.*) Transverse section of portion of a bee's stomach, showing the internal lining of club-shaped epithelial cells packed with the spores of *Nosema apis*; highly magnified. (*b.*) Spores greatly enlarged, showing circular vacuoles.

[*Drawing by E. H. Atkinson.*

Nosema apis is a recognized parasite—it lives at the expense of the bee. As to the injury it inflicts, this is a matter upon which there has been much divergence of opinion. In 1912, for instance, Graham-Smith, Fantham, and Porter, in view of their accumulated evidence, stated that "the writers consider themselves justified in taking the view that *Nosema apis* is the causative agent in most outbreaks of disease in which the Isle of Wight symptoms are present." In

1919 White wrote: "For the present the American beekeeper should bear in mind that where Nosema disease is given as the diagnosis a condition having the destructiveness described for the Isle of Wight disease is not meant." Finally, Rennie (1921) announced the occurrence of a parasitic mite, *Tarsonemus woodi*, in the respiratory passages of the bee. On abundant evidence he believed this to be the cause of Isle of Wight disease.

In New Zealand we have had no epidemic comparable to the destructive Isle of Wight disease. We have recently discovered the presence of *Nosema apis*, but it is incredible that this organism is of recent introduction. *Nosema apis* has not directly been associated by us with any specific disease. Symptoms kindred to those commonly associated with "spring dwindling" have, it is reported, been observed. Our object then should be (1) to arrive at the distribution of this animal parasite, and (2) to ascertain its effects upon the bee.

So far the parasite has been sought and found in but two places—Auckland and Te Puke. The stomachs of four hundred Auckland bees have been examined. Of these ten showed traces of the spores, one abounded with them, and one showed a fair number of the vegetative form of the organism. A naked-eye examination of thirty-five stomachs at Te Puke showed only one that looked suspicious. This was brought to Auckland, where it was found to be packed with spores. Minor infection among the Te Puke bees may have gone undetected.

The writer will be pleased to examine any bees for the presence of the Nosema organism. Specimens should be sent—preferably alive—addressed care of the Biological Laboratory, 71 Fairlie Terrace, Wellington. An account of any observed symptoms should accompany the specimens. Next spring may afford an opportunity of associating the symptoms with the parasite, for then the effects of spring dwindling and certain other obscure bee troubles may become more noticeable.

Regarding the symptoms of Nosema disease, White says that weakness, especially in the spring of the year, should cause a suspicion that the disease is present. Further, that this suspicion is strengthened if in such a colony the brood in general is normal; if the adult bees are not noticeably different in outward appearance or behaviour from bees of healthy colonies; if the queen is present; and if stores are abundant. His recommendations show that bees sent for examination should be workers from the field—pollen, water, or honey carriers. Next to field-bees those about the entrance of the hives should be selected—ten or more per colony. The contamination by excrement and otherwise of the water-supply, and the robbing of weakened and diseased colonies, are considered to be the main means of infection.

It will be noted that the present tendency is to abandon the idea that *Nosema apis* is the cause of the Isle of Wight disease, and to view the disease arising from the Nosema parasite as of minor importance. New Zealand experience certainly suggests such a view. Nevertheless, we should not neglect this organism until our local knowledge of its effects shall have justified us in doing so.

SEED-TESTING NOTES.

"CHEAP" MIXTURES.

NELSON R. FOY, Biological Laboratory, Wellington.

PURE seed should be the farmer's first consideration; impure cheap seed is the worst investment he can make. A "bargain" in seed-buying is a big temptation, but it can safely be taken that there are no bargains in the seed trade. The seed-merchant knows to a fraction the market price of seed of average quality, and he is hardly likely to sell good seed below market rates. These bargains usually consist of seed-cleanings placed on the market as a pasture "mixture" at a very low figure. Fortunately, most merchants have realized that the sale of such cheap inferior seed is detrimental to business, and a considerable quantity of seed-cleanings, which a few years ago may have been placed on the market as pasture mixtures, is now destroyed or ground into fowl or stock foods. However, a few of these lines still find their way on to the market, either through the auction-r om or the merchant who is not over particular in his dealings. Farmers should be particularly wary of seed sold by auction, as although it may not be extraordinarily cheap in price it is usually cheap in quality and in the long-run an expensive purchase.

A sample of one of these mixtures was recently received at this Laboratory, and an analysis gave the following results (see illustration) :—

Constituents.	Percentage of Sample.	
Weed-seeds*	53·0	Rubbish, 69 per cent.
Dirt, sticks, &c.	9·0	
Australian flax	7·0	
Rye-grass	18·0	Useful seed, 31 per cent.
Red clover	6·5	
Lotus major	2·0	
Cocksfoot	1·5	
White clover	1·5	
Poa pratensis	1·4	
Crested dogstail	0·1	
Suckling-clover	Trace	
Yorkshire fog	Trace	
	100·0	

* The weed-seeds included the following: Rib-grass, ovoid spike-rush, selfheal, catsear, sweet vernal, curled dock, ergot, hawkbit, creeping buttercup, catchfly, goose-grass, hair-grass, and sorrel.

It will be seen that less than one-third of the mixture is composed of useful pasture-grasses and clovers, while the remaining two-thirds is not only useless, but the large percentage of weed-seeds contained therein makes it detrimental to the land upon which it is sown. The price of this particular line is not known; but even if it were sold at, say, 6d. per pound the purchaser is buying two pounds of rubbish to one pound of seed, making the actual price of the seed contained 1s. 6d. per pound. On current market prices the average price for best-quality seeds of the same species works out at 1s. 3d. per pound, without the 50 per cent. of weed-seeds thrown in. It is thus difficult to see where the "bargain" comes in.

Another instance of the auction-room bargain may be cited: A few months ago an intending purchaser visited an auctioneer's establishment where "excellent seed" was being offered at tempting prices. In appearance the seed was all that could be desired, but unfortunately for the vendor the price was so low that the purchaser became suspicious. In order to be positive that he really could buy white-clover seed at 9d. per pound he had the sample analysed at this Laboratory. An analysis showed that the sample contained only 4 per cent. of white clover, the remainder consisting almost wholly of clustered clover, a weed clover of neither commercial nor agricultural value. This form of deception is particularly easy, as clustered clover very closely resembles white in shape, size, and colour, and it is only to the expert eye that the difference is apparent.

ANALYSIS OF A "CHEAP" SEED-MIXTURE (SEE OPPOSITE PAGE).

(1) One gram of mixture; (2) weed-seeds, 53 per cent.; (3) dirt, &c., 9 per cent.; (4) Australian flax, 7 per cent.; (5) perennial rye-grass, 18 per cent.; (6) red clover, 6·5 per cent.; (7) Lotus major, 2 per cent.; (8) white clover, 1·5 per cent.; (9) cocksfoot, 1·5 per cent.; (10) Poa pratensis, 1·4 per cent.; (11) crested dogstail, 0·1 per cent. (Nos. 2 to 11 form the analysis of No. 1.)

The best seed is the cheapest, whatever the price, and quality should be the one factor that determines a purchase. Unless based on a scientific analysis an opinion as to the quality of seed is useless. Seed bought from other than reputable merchants should first be tested for purity and germination. Scientific seed-analysis is carried out at this Laboratory, and the service is free to farmers.

SOME RECENT LUCERNE EXPERIENCE IN CANTERBURY.

F. E. WARD, Instructor in Agriculture, Christchurch.

(1.) FERTILIZER EXPERIMENTS AT ASHBURTON.

THE effect of phosphatic manuring on lucerne-establishment in Canterbury is a matter upon which there have been divergent opinions and regarding which fuller information is required. An interim report on the Ashburton Experimental Farm tests designed for this purpose appeared in the last December issue of the *Journal*. The results for the first season are now available, and they supply useful data regarding total yield and the effects of manures on wide- and narrow-drilled sowings.

The 20-acre area sown in March, 1921, received inoculated soil on the western half at the rate of 3 cwt. per acre. Three cuts were secured from the area during the season, the weighing of the first two being recorded in the following table. Owing to dry weather conditions the third cut was very light all over the field, and in consequence weighings were disregarded.

WEIGHINGS OF LUCERNE-PLOT YIELDS (GREEN WEIGHT).

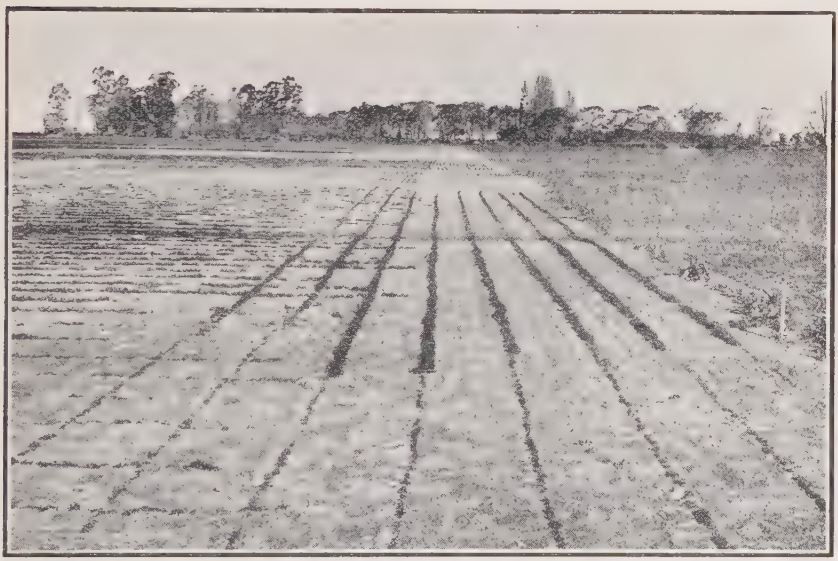
Rows.	Manured.		Unmanured.	
	3 Cwt. Inoculated Soil added per Acre.	No Inoculated Soil added.	3 Cwt. Inoculated Soil added per Acre.	No Inoculated Soil added.
	Tons.	Tons.	Tons.	Tons.
7 in.	4·75	..	1·50	..
	2·43	1·62	1·62	0·81
	7·18		3·12	
14 in.	4·00	..	2·00	..
	3·82	2·28	2·42	1·21
	7·82		4·42	
21 in.	3·33	..	1·66	..
	3·23	2·38	2·59	1·73
	6·56		4·25	

Total weights on inoculated-soil plots: Manured, 21·56 tons; unmanured, 11·79 tons. No weighings were taken on the non-inoculated-soil plots at the first cut.

The effect of manuring with 2 cwt. per acre of superphosphate was most marked throughout the season, and the yields were approximately in the proportion of two to one in favour of manure. The lucerne was sown in rows 7 in., 14 in., and 21 in. apart, and the heaviest yields were secured from the 14 in. rows on the manured portion, the 7 in. rows yielding slightly less.

LUCERNE PLOTS AT ASHBURTON EXPERIMENTAL FARM.

On left, unmanured rows; on right, manured rows. Sown 7/3/21; photo taken 13/9/21.



ANOTHER VIEW ON THE LUCERNE EXPERIMENTAL PLOTS, SHOWING HEADLAND.

In foreground, unmanured strip; next, a manured strip; then unmanured and manured alternating similarly.

[*E. B. Levy, photos.*

In the non-manured series the 14 in. rows were again the best, but here the 21 in. rows were better than the 7 in. rows. This can no doubt be explained by the fact of the 21 in. rows giving more feeding-room for the roots than the 7 in. It is interesting to note that where neither inoculated soil nor manure were applied the wide drills gave the best results, but where inoculation and manure were supplied the yields were much heavier and in favour of the closer sowings. A rather surprising feature of the trial was that the inoculated-soil plots gave results almost identical with the plots receiving 2 cwt. of super-phosphate without inoculated soil.

Summarizing the results, it will be seen that with inoculated soil and super the yields were approximately double those of the plots receiving inoculated soil only. Inoculated soil alone equalled super alone. The heaviest yields were obtained from 14 in. rows and 7 in. rows, these giving heavier yields than 21 in. rows when inoculated soil and super were used.

(2.) RAILWAY DEMONSTRATIONAL AREAS.

THE following is a brief account of the lucerne areas laid down alongside the railway-line at Templeton, Bankside, and Ashburton respectively, also of a similar plot at Darfield. These areas were selected on light shingly country to demonstrate whether such lands could be put to profitable use by growing lucerne under a system of wide drills with intercultivation. It was necessary in some cases to remove the larger stones to enable implements of cultivation to do their work. Even when these were removed the matter of intercultivation was a difficulty and very hard on implements. Had the yields from these areas been satisfactory the expense involved in their establishment would doubtless have been justified. It is to be regretted, however, that the yields have been very light, and in view of the experience gained lucerne-growing on such lands cannot be recommended. Three of the areas—Templeton, Ashburton, and Darfield—were used for hay-production, but as the yields were so light it was found necessary to convert Ashburton and Darfield into grazing trials. The following notes give particulars of the past season's results :—

Templeton.—Area, 3½ acres ; sown in 21 in. drills, October, 1918, with 1 ton burnt lime per acre ; final application of inoculated soil given in June, 1920. The area has been cut for hay three times this season, giving the following quantities of hay : First cut, 2·46 tons ; second cut, 1·36 tons ; third cut, 0·5 ton : total, 4·32 tons, or 1·23 tons per acre for the season. The area was intercultivated after each cut.

Bankside.—Area, 4 acres ; sown in 21 in. drills, October, 1917, with 24 cwt. carbonate of lime per acre, burnt lime being added later. Inoculated soil was applied at time of sowing, Two acres were intersown with a grass-mixture in the autumn of 1919. This season the area was grazed with sheep three times, the carrying-capacity calculated in sheep per acre per annum being as follows : First grazing, 0·67 ; second grazing, 0·28 ; third grazing, 0·5 sheep : total, 1·45 sheep per acre per annum. Intercultivation was given after each cut except the last one. The area is to be winter-worked.

Ashburton.—Area, 7 acres; sown in 21 in. drills, portion in January, 1918, and portion in January, 1919. Sown with 1 ton burnt lime per acre. Inoculated soil was applied in January, 1919. The area yielded one cut of hay in the spring, amounting to 4 tons, or 0·57 ton per acre. It was twice grazed with sheep, as follows: First grazing, 0·39 sheep; second grazing, 0·57 sheep: total, 0·96 sheep per acre per annum. No intercultivation was given during the growing season of 1921–22. The plot is to be winter-worked.

Darfield.—Area, $3\frac{3}{4}$ acres; sown December, 1917, in 21 in. drills, with $1\frac{1}{2}$ tons burnt lime per acre. Inoculated soil applied at the rate of 3 cwt. per acre at time of sowing, and further application made in June, 1920. The yield for the season was one crop of hay and two grazings. The hay yielded 1·87 tons, or 0·5 ton per acre. First grazing, 0·6 sheep; second grazing, 0·5 sheep: total, 1·1 sheep per acre per annum. An intercultivation was given after each crop.

In order to give some idea of the financial value of such crops as were obtained from these areas, the last grazing on the Ashburton plot may be cited as a typical example. The grazing was let at 3d. per head of sheep per week. The growth, which represented about one-quarter of the total yield for the season, carried 104 sheep for fourteen days, netting a return of £2 12s. from the seven acres, or 7s. 6d. per acre. Thus for the season the return was approximately £1 10s. per acre, and this would hardly pay rent and working-expenses on such land.

EUCALYPTS IN NEW ZEALAND.

EXPERIENCE WITH VARIOUS SPECIES.

H. A. GOUDIE, Conservator of Forests, Rotorua.

[Paper read at the Annual Conference of the New Zealand Association of Nurserymen, Christchurch, January, 1922.]

In the consideration of any scheme of afforestation, either private or by a local body or Government, the importance of the genus *Eucalyptus* is such as to warrant it receiving special attention. This genus includes many species which may be rightly regarded as being amongst the most important of the world's timber-trees. It is true that the physical characteristics of the eucalypt timbers do not fit them for such a wide range of purposes as do the softer woods of the pine family, but for uses where strength, hardness, or durability are essential qualities the woods of several of this genus have few, if any, equals. In this country these timbers are usually associated with such works as wharf and bridge construction, telephone and electric-transmission poles, wood paving, railway-sleepers, and vehicle-construction; and farmers generally regard a *Eucalyptus* tree as a source from which to obtain a supply of durable fencing-timber. In Australia and Tasmania these timbers are applied to all the purposes just mentioned, but in addition many of the softer kinds are largely used for building-construction and furniture.

The durability of the timbers of many of the species accounts for their popularity among private planters. For many years, and to some extent still, intending planters have regarded this genus as being composed of one species—namely, the Tasmanian blue-gum, or *Eucalyptus globulus*. Of recent years it has become more widely known that there are other species more worthy of attention, and consequently at the present time there is a wide demand amongst interested persons for information regarding species which can be successfully grown in various parts of the Dominion. Fortunately, the planting which has been done during the past forty years affords us much reliable information in this respect. There are, however, probably still a number of useful species which might be introduced, but in respect to such it is unsafe to predict without making reliable experiments with them. At Rotorua the State Forest Service has experimented with seventy species. Of these, twenty-seven can be classed as successful and suitable for the climate there; ten have been partially successful, or, in other words, have succeeded in selected sites; eleven are doubtful, the trials being of too recent a date to make a more definite statement upon the results; and twenty-two have failed owing to the unsuitability of the climate.

From the results of such experimental work and by the observation of the efforts of private planters it is possible to offer fairly accurate information to an intending planter. It should be borne in mind, however, that there are many factors which go to make up a climate, and that there are sometimes local conditions in a district which require special observation before the behaviour of any particular species can be forecasted accurately. The knowledge of the climatic conditions of a district is much more important than information regarding the soil, because failures with eucalypts are oftener due to an adverse climate than to an unsuitable soil. In a general way it may be said that eucalypts are not fastidious as to soil, because the same species is often found growing equally well in soils of quite diverse characters. The moisture content of the soil is, however, a very important consideration, as all the species make large demands upon the soil-moisture, while some will fail utterly unless they are able to get plenty of moisture. All species are more or less susceptible to saline winds, and seldom make satisfactory growth near the sea-coast unless sheltered from winds directly off the sea.

We already have passed through several phases of eucalypt-culture in New Zealand, and from each of these there are lessons to be learned. The first of these may be said to be the period in which the Tasmanian blue-gum was the species universally planted and regarded as a tree of high merit. Later, as the timber of these trees reached usable size, it was found that this species, upon which much of the reputation of the Tasmanian timber trade rested, did not quickly produce durable timber in this country. It was realized too late that the Tasmanian blue-gum does not form durable heartwood early in life. A prejudice against the eucalypts then set in, and for a number of years it was widely thought that it was waste of time to plant them. From eight to ten years ago the recognition of the durable *E. Macarthuri* in the Waikato caused intending planters to again give this genus the attention it deserves, but it is rather unfortunate that this enthusiasm has resulted in other better species being neglected to a large extent. From these remarks it must not be concluded that *E. Macarthuri* is not recommended for planting; on the contrary, it has many qualities to recommend it. Its

only defect is that it seasons badly, and whilst being an excellent tree for the production of fence-posts, firewood, and shelter it fails to fulfil many purposes which other equally durable species would serve. *E. Macarthuri*, owing to its hardy nature and good transplanting qualities, will, of course, thrive where many other species might fail, and must necessarily still be planted to some considerable extent. We must, however, avoid the error of planting it to the exclusion of other and better species, where these will succeed. If a wise selection of species is made by planters, the growing of eucalypts should prove a very profitable business. Species suitable for electric-transmission poles, railway-sleepers, bridge, wharf, and similar heavy construction timbers, as well as timbers for railway and street cars and ordinary vehicles, will in the comparatively near future find a ready and profitable market. An acre of such timber thirty to forty years of age should be worth (at present rates) from £750 to £1,500, according to species and accessibility.

An attempt has been made hereunder to classify species according to their relative merits. All are now growing successfully in various parts of the Dominion :—

(1.) Durable timbers suitable for electric-transmission poles or for sawing into planks and applying to uses where strength and durability are essential qualities : *E. pilularis* (New South Wales), blackbutt ; *E. saligna* (New South Wales), flooded gum ; *E. Muelleriana* (Victoria and New South Wales), yellow stringybark ; *E. eugenioides* (New South Wales and Queensland), white stringybark ; *E. Gunnii* (Tasmania), cider-gum.

(2.) Durable timbers valuable for fencing and like purposes, but of inferior quality for saw-bench : *E. Macarthuri, E. siminalis, E. botyroides, E. ovata.* It is possible that these species may be useful for using as poles, but the tendency of the timber to crack radially is a drawback. This disability may yet be overcome by proper seasoning methods.

(3.) Softer timbers, not possessing great durability when in contact with the ground, but valuable for milling and for general construction purposes : *E. fastigata, E. gigantea, E. obliqua, E. regnans.*

BRIEF DESCRIPTION OF SOME OF THE SPECIES COMMONLY FOUND GROWING IN VARIOUS PARTS OF NEW ZEALAND.

E. amygdalina.—The narrow-leaved Tasmanian variety is fairly common throughout New Zealand. Grows at Rotorua, and has been observed as far south as Dunedin. It is usually a very tortuous grower, and slow except in rich alluvial soils. Timber has a reputation for durability, but there are other species, straighter and more vigorous growing, which it would be more profitable to plant. Easy to transplant.

E. botryoides.—This may be classed as a moderately hardy species. It grows fairly well at Rotorua if planted on sheltered slopes, but generally gets killed out by frost on the lower levels. At Cambridge, in the Waikato, it is moderately fast, while in the Whangarei district it has proved a fast and vigorous grower. This species produces a red-coloured timber suitable for the construction of bridges, culverts, fencing, and similar purposes. Somewhat difficult to transplant.

E. coriacea.—A very hardy species, fairly common throughout the North Island and in Canterbury. Trees fairly fast, but not tall-growing ; trunk usually twisted and much branched. Timber suitable for fencing and fuel. A useful tree for cold regions. Easily transplanted.

E. corynocalyx (sugar-gum).—A moderately hardy species recorded in the Wairarapa and Whangarei districts. Tolerates frosts to a slight degree only, and although it produces a valuable and durable timber it cannot be recommended for planting except in favoured parts of the North Island. Not easily transplanted.

E. diversicolor (karri of West Australia).—Thriving specimens have been noted at Whangarei and Tauranga. At Rotorua a few plants are still alive, but are annually touched by frost. In warm localities this species grows quickly into a very handsome tree, and will produce a valuable building-timber. Fairly easily transplanted.

E. eugenioides.—This valuable stringybark has succeeded admirably in the Waikato districts, where it grows into a tall, straight tree devoid of any large branches. At Rotorua young plants are badly affected by frosts for the first four years, but are seldom killed outright. Rotorua is probably just beyond the range of its usefulness. It is strongly recommended for planting in localities where winter frosts do not exceed about six degrees Fahrenheit. Timber is strong, pink in colour, very durable, splits readily, and suitable for general carpentry, electric-transmission poles, railway-sleepers, bridge-construction, and fencing. Difficult to transplant.

E. fastigata.—This valuable species has succeeded in a remarkable degree in the Waikato, Rotorua, and other districts in the North Island where the winter temperature may be classed as moderately cold. It is somewhat tender in the seedling stage, and not an easy transplanter. Many magnificent specimens are to be seen in the Waikato adjacent to the Auckland–Rotorua Railway and branch lines, some of them reaching a height of 150 ft. The timber of this species is of a pale-straw colour, moderately strong and fissile, and well suited for house-construction and similar purposes. No definite instance can be quoted of its New-Zealand-grown timber having been tried and found durable in contact with the ground, but in the meantime it may be safely assumed that the heart-wood is at least moderately durable for fence-posts and like purposes. The very rapid growth made by this species recommends it for extensive planting. It will probably produce a greater quantity of timber in a given time than any other introduced tree. It should be tried in warmer parts of the South Island in localities where unseasonable frosts are not prevalent or severe. Must be very carefully handled when transplanting.

E. gigantea.—This is a reputedly hardy species indigenous to the mountains of Victoria and New South Wales. Trials in New Zealand have as yet not revealed any very definite information regarding its range of usefulness. At Rotorua it has proved a hardy and fairly vigorous grower, and it seems safe to assume that it will prove a valuable species in the South Island and the colder parts of the North. The timber is reputed to be valuable and in much the same class as that of *E. regnans, E. fastigata,* and *E. obliqua.* Not difficult to transplant.

E. globulus.—This, the well-known blue-gum of Tasmania, has been widely planted in New Zealand and scarcely requires a description here. Almost everywhere it has been attacked by insect pests, which seriously affect the vigour of the tree and in some cases kill it outright. On this account its cultivation in many districts is not recommended. A variety

which bears three flowers in a cluster is a worthless tree, but the one which produces its flowers singly often grows to a large size and produces useful timber.

E. Gunnii.—The cider-gum of Tasmania, and probably the hardiest species yet introduced into this country. Common in Southland, and has grown under very cold climatic conditions at Waiotapu, in the Rotorua and Taupo Counties. Not a large-growing species, except in extra-fertile soil. The timber is hard and strong, and is reputed to be durable in contact with the ground. Not difficult to transplant.

E. Macarthuri.—This species has been most successful in and near Cambridge and Hamilton, in the Waikato district, where trees up to 120 ft. in height may be seen on rich, moist land. It has proved hardy at Rotorua, but there the growth is much slower than in the Waikato. This species has been widely planted during recent years, and appears to succeed over a wide range of conditions, and may safely be regarded as moderately hardy and suitable for all except the coldest parts of the North and South Island. It is of slow growth and inclined to be very branchy in dry soils, and is very intolerant of saline winds. Timber is reddish-brown in colour, very durable, and makes excellent fuel, but seasons badly. One of the easiest species to transplant.

E. maculata.—As far as can be ascertained, this tree has not been tried very extensively in New Zealand. Some years ago an experimental plot was planted by the State Forest Service at Kamo, in the Whangarei district, and the results show that the species is at home there. It is a fairly quick grower, but very intolerant of frost, and likely to be useful only in the milder parts of the North Island. The timber is known commercially as spotted gum, and used extensively for shafts of vehicles and like purposes.

E. Muelleriana.—A moderately hardy tree, the range of which in New Zealand is as yet conjectural. It has grown fairly satisfactorily on the slopes of hills at Rotorua, but fails if planted on the flats where the frosts are more severe. It would probably succeed well in the Waikato and similar climates. Timber is the yellow stringybark of Victoria, where it is used extensively for poles, sleepers, bridges, and like purposes. Must be carefully handled when transplanting.

E. obliqua.—This is a fairly hardy species, and will grow wherever the common blue-gum succeeds. It is, however, extremely tender in the seedling stage, and many failures have resulted owing to unfortunate weather conditions occurring during the first year of the life of the tree. Flourishing specimens may be seen at Rotorua and at Waiotapu, where the winter temperatures have been as low as 15° F. It grows well also on Banks Peninsula, and moderately well in Dunedin. This is the valuable Tasmanian stringybark, the timber of which in years past was brought to New Zealand as Hobart shingles, palings, and rails. The New-Zealand-grown timber has not a high reputation for durability, and it would appear that this species does not make durable heartwood until late in life. The timber splits readily and makes excellent rails. In Tasmania it is largely used for furniture, and is known as Tasmanian oak. It is also largely used in the construction of buildings, from the framing to the interior finishings. It is one of the best species found growing on the west coast of Wellington, and appears to be less susceptible to saline winds than most other species. Most difficult to transplant unless grown in trays and transplanted with a ball of earth.

E. ovata.—This species has been extensively grown at Rotorua, where it has proved a hardy, quick-growing, and easily transplanted tree. Specimens have also been noted in Manawatu district, and from general observations it may be regarded as a very hardy tree, suitable for all except the very cold parts of New Zealand. From the meagre information available regarding the quality of its timber it is not possible to make any very definite statements, except that the heart-wood, which is formed early in the life of the tree, is durable in contact with the ground.

E. pilularis.—This species is known in New South Wales as black-butt, and is there regarded as one of the most valuable indigenous species. It has been found growing to a most satisfactory size in parts of the Waikato, but it has failed at Rotorua, and may be regarded as a species suitable only for the warmer parts of the North Island. It requires fairly moist soil, and needs to be carefully handled when transplanted. The timber is exceedingly durable, and used for bridge-planking, house and ship building, wood paving, railway-sleepers, and in the construction of railway-wagons.

E. regnans.—The description already given for *E. obliqua* would apply equally well to this species. It has grown well at Rotorua, and is flourishing at Waitati, near Dunedin, where it has spread from the mother tree over quite a large adjacent area. Unlike the *obliqua*, it is a smooth-barked tree. The timber is known in Victoria as peppermint-gum, where it is used for house-construction. It is generally regarded as better than *E. obliqua* on account of the fact that gum veins are not generally so prevalent in it.

E. risdoni var. *elata.*—This species has been grown to some extent at Rotorua, where it has succeeded admirably except in low-lying situations where frosts are particularly severe. The stock raised at Rotorua was grown from seed collected and supplied from Mr. T. W. Adams's plantations at Greendale, Canterbury. It is a somewhat tortuous-growing tree, and the timber is of doubtful technical value, but it may be regarded as durable and suitable for growing for fencing-timbers and fuel. It is not difficult to transplant.

E. rostrata.—This is the Murray River red-gum of Victoria. It will succeed only in soil that is constantly moist, and even then it is a somewhat tortuous grower. The timber is a rich pink colour, extremely durable, easily split, and suitable for railway-sleepers and like purposes. Not easily transplanted.

E. saligna.—This is known in New South Wales as flooded gum or Sydney blue-gum. It grows well in Waikato, and has succeeded moderately well at Rotorua in selected situations. It is a tree which requires fairly moist and fertile soil, and should be planted only in the fairly warm parts of the North Island. The timber is extremely valuable for all purposes where strength and durability are necessary qualities. Should be transplanted carefully.

E. viminalis.—In the southern parts of Australia and in Tasmania this tree is known as the manna-gum, and is there regarded as a tree of secondary importance. In the Waikato and in a great many parts of the North Island it rapidly grows into a tall, straight, and beautiful tree. It is quite hardy at Rotorua, and has succeeded well in North Canterbury, at St. Helens Station. It may be regarded as a species suitable for all except the extremely warm parts of New Zealand. The

timber is pale in colour, easily split, and has been proved to be very durable in contact with the ground. Unfortunately, it does not season very well, and is therefore not very suitable for sawing into planks. It may, however, prove valuable when used in the ground for electric-transmission poles and like purposes. One of the easiest species to transplant.

LIST OF EUCALYPTS TRIED AT ROTORUA.

S—Successful; suitable so far as climatic conditions are concerned. D—Doubtful as to ultimate result. P—Partial success; grows moderately well in selected aspects. F—Failure; climate too cold.

E. Andrewsii	..	P.	*E. gigantea*	..	S.	*E. piperita*	..	S.
E. aggregata	..	S.	*E. globulus*	..	S.	*E. polyanthemos*	..	P.
E. alpens	..	D.	*E. gomphocephala*	..	F.	*E. punctata*	..	F.
E. amygdalina (N.S.W.)		S.	*E. goniocalyx*	..	D.	*E. regnans*	..	S.
E. amygdalina (Tasm.)		S.	*E. Gunnii*	..	S.	*E. reduncа*	..	F.
E. botryoides	..	P.	*E. haemastoma*	..	S.	*E. resinifera*	..	F.
E. calophylla	..	P.	*E. hemiphloia*	..	F.	*E. resinifera* var. *gran-dif*	..	D.
E. cambagei	..	P.	*E. Kirtoniana*	..	D.			
E. camphora	..	S.	*E. leucoxylon*	..	F.	*E. risdoni* var. *elata*	..	S.
E. capitellata	..	S.	*E. Macarthuri*	..	S.	*E. rostrata*	..	F.
E. coccifera	..	S.	*E. maculata*	..	F.	*E. saligna*	..	P.
E. consideniana	..	F.	*E. maculosa*	..	D.	*E. sulmonophloia*	..	F.
E. cordata	..	S.	*E. marginata*	..	F.	*E. Sieberiana*	..	S.
E. coriacea	..	S.	*E. melliodora*	..	D.	*E. Siderophloia*	..	F.
E. cornuta	..	F.	*E. Muelleri*	..	S.	*E. Sideroxylon*	..	F.
E. corynocalyx	..	F.	*E. Muelleriana*	..	P.	*E. Smithii*	..	S.
E. citriodora	..	F.	*E. numerosa*	..	F.	*E. stellulata*	..	F.
E. crebra	..	F.	*E. obliqua*	..	S.	*E. Stuartiana*	..	S.
E. diversicolor	..	D.	*E. occidentalis*	..	F.	*E. tereticornis*	..	P.
E. Dawsoni	..	D.	*E. odorata*	..	F.	*E. umbra*	..	D.
E. eugenioides	..	P.	*E. oreades*	..	S.	*E. unialata*	..	S.
E. eximia	..	D.	*E. ovata*	..	S.	*E. urnigera*	..	S.
E. fastigata	..	S.	*E. patens*	..	F.	*E. viminalis*	..	S.
E. ficifolia	..	P.	*E. pilularis*	..	D.			

Errata.—Two inadvertencies occurred in the part of the article "Some Recent Changes in the Names of Plant-diseases" published in the February *Journal*. On page 98, under the heading of "Wheat," the common name of the disease *Puccinia dispersa* Erikss et Henn. is given as "leaf-rust" instead of "blade-rust," the former being a rejected name. Similarly, on page 101 of the same issue, among the diseases of potatoes, "dry-rot" is given instead of "Fusarium rot" as the common name of *Fusarium oxysporum* Schlecht.

Chewings Fescue Seed.—Exporters of this seed to the United States are advised to ship it as early as possible, so that it may arrive in good time for autumn sowing in that country.

Energy and Crop-growth.—Dr. E. J. Russell, in an article on the work of the Rothamsted Experimental Station from 1918 to 1920, published in the *Journal of the Ministry of Agriculture* (England), makes the following remarks: "Careful tests have been made of the effect of high-tension electric discharge on crop-growth; of the electrical and other treatment of seeds; of the effect of radium-ores; of stimulating substances such as boric acid; and of other plans which have been proposed for improving plant-growth. Some of these offer a certain amount of promise, others do not; none of them is yet in a stage to recommend to farmers."

FIG. 1. A GENERAL VIEW OF THE TAUHERENIKAU REPATRIATION FARM ESTABLISHMENT, SHOWING THE MEN'S QUARTERS, ETC.

The view is backed by the Tararua Range.

FIG. 2. THE HONEY-HOUSE AND PART OF THE APIARY AT THE TAUHERENIKAU FARM.

TAUHERENIKAU REPATRIATION FARM.

TRAINING FOR TUBERCULAR RETURNED SOLDIERS.

It was early recognized by the Repatriation Department (under Hon. D. H. Guthrie) that the best life for a tubercular man is an open-air one. For that reason the Director (Mr. J. R. Samson), soon after the passing of the Repatriation Act in 1918, set out, with the assistance of the Department of Agriculture, to establish a training-farm at Tauherenikau, in the Wairarapa district, where returned soldiers suffering from chest trouble could be trained in poultry-keeping, beekeeping, horticulture, and general light farming so as to enable them to take up small holdings of their own under the Discharged Soldiers Settlement Act. The general lay-out and control of the Tauherenikau Farm, of 570 acres, were placed in the hands of Mr. J. L. Bruce, Superintendent of Experimental Farms, and the actual management of the various detailed activities of the farm was undertaken by Mr. J. Brydon, an experienced farmer and returned soldier of long service.

The accompanying photographs afford a very good idea of the training-farm. Fig. 1 gives a general view of the establishment, with part of the apiary in the foreground. On the left of the water-race is the farm-manager's house, office, &c. In the middle distance is the implement-shed and barn, and the small building adjoining holds the lighting plant. The large building to the right of that, of which only a small portion can be seen in the picture, is the men's sleeping-quarters, where there are sixty cubicles constructed largely on the open-air principle, and opening on to a sun-veranda. The other large building on the right contains the dining-hall and recreation-room.

Fig. 2 shows the honey-house and apiary, which latter extends beyond the pine-trees on to the main roadway running through the farm. The site is picturesque and suitable in every respect, and the trainees in this section, under a most enthusiastic instructor, Mr Booth, have acquitted themselves well.

Coming to the poultry section, Fig. 3 gives a view taking in as much as possible of the laying-houses on the left and the incubator-room, brooder-house, egg-room, and offices on the right. The plant was laid out and organized under the direct supervision of Mr. F. C. Brown, Chief Poultry Instructor to the Department of Agriculture, who has also given his services in an advisory capacity generally. The management of the section is in the hands of Mr. W. B. Sinclair, who was one of the most successful trainees at the Avonhead Repatriation Poultry-farm. The flock of White Leghorns last year comprised some 450 layers, who demonstrated their quality by a heavy yield. The new season's hatching and brooding operations have resulted in an addition to the stock of 650 pullets, and the section generally is a credit to all concerned.

Fig. 4 shows part of the 12 acres of market garden, in charge of Mr. R. Curran. This picture, taken in February, hardly does justice to the large variety of vegetables that are being grown by a number of enthusiastic and hardworking trainees on this section.

FIG. 3. THE POULTRY SECTION AT TAUHERENIKAU.

Part of the laying-houses is seen on the left; on the right are the brooder-house, incubator-room, &c.

FIG. 4. PART OF THE TWELVE-ACRE AREA OF MARKET GARDEN.

Photograph taken in February.

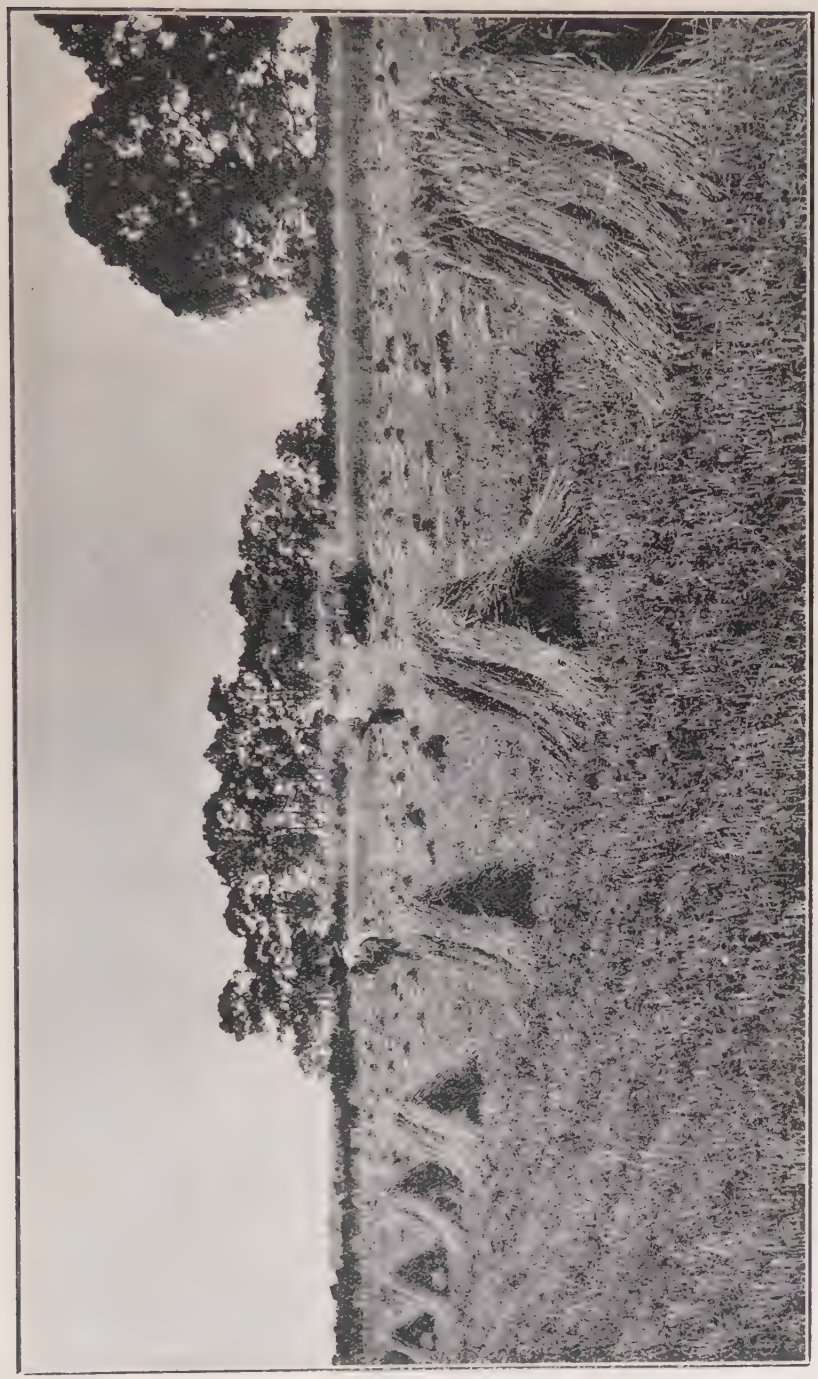


FIG. 5. HARVESTING THE WHEAT CROP ON THE TAUHERENIKAU REPATRIATION FARM.

The full-page photograph (Fig. 5) illustrates what the farm has accomplished in wheat-growing. The harvesting shown in progress is that of this season's crop of Solid-straw Tuscan, which has threshed out 40 bushels to the acre. Last year's crop of the same variety yielded 53 bushels per acre.

A large number of tubercular men have now passed through the farm, most of them receiving twelve months' training. It is pleasing to note that in practically all cases the trainees improved considerably in health during their stay on the farm, and that the number of those who had to return to the Pukeora Sanatorium for treatment was negligible. The Repatriation Department employs a clerical officer on the farm, a man with sanatorium training, who sees that proper hours for rest and rising and retiring are observed, and that the conditions, generally speaking, are such as the men have been taught to observe in the sanatorium. The institution is visited at frequent intervals by medical specialists of the Health Department, and by the Tuberculosis Officer, Mr. H. J. Aekins. The wants of the inner man are well catered for, and plenty of nourishing food, largely produced on the farm, is provided. Moreover, the trainees receive a sustenance allowance in addition to their pensions.

It is evident that on the Tauherenikau Farm men suffering from chest trouble have the best possible opportunity of renewing their strength amid congenial surroundings in the clean open air of the Wairarapa. All will wish the institution continued success until its mission is ended.

LAND LEGISLATION OF 1921-22 SESSION.

THE following is a brief summary of the land legislation affecting rural interests which was enacted during the parliamentary session of 1921–22.

Land Laws Amendment Act.—Part I gives effect to certain recommendations made by the Southern Pastoral Lands Commission, 1919, which was appointed to inquire into the best manner of improving the conditions of settlement of pastoral lands, &c. The principal provisions of this part of the Act are as follows: The maximum term that may be fixed for a pastoral lease is increased from twenty-one to thirty-five years. Pastoral licenses for the occupation of Crown lands, and leases of education reserves or other endowments comprising pastoral lands administered by Land Boards, granted for a term of not less than fourteen years, may be extended for a further term of fourteen years at the rents reserved by existing leases or licenses. Under certain conditions the freehold can be acquired of such pastoral runs as, in the opinion of the Land Board, are of no greater area than is sufficient for the maintenance of the lessees and their families. Power is given to postpone rents of pastoral runs in the same manner as they can be postponed under other tenures. In the case of pastoral runs suitable for subdivision the determination to subdivide must be made, when practicable, not later than two years before the expiration of licenses.

The principal provisions of Part II of the Act are as follows: With the object of alleviating hardship owing to a general financial

stringency, and of enabling smaller instalments to be charged, the term of a deferred-payment license can be extended to a period of twenty-four years. In order that revaluations of small grazing-runs of which the leases are expiring can be postponed until values are stabilized, leases of small grazing-runs may be extended for a further period of five years. This provision is restricted to leases which will expire within five years from the date of the passing of the Act, and to certain expired leases which had not been renewed.

Discharged Soldiers Settlement Amendment Act.—The main purpose of this Act is to prescribe the procedure and provide the necessary machinery for the realization of the estates or interests of discharged soldiers which may come into possession of the Crown through foreclosure, &c. Provision is also made whereby, with the object of easing the financial position of those soldiers who have selected their holdings on deferred-payment licenses, such licenses can be exchanged for renewable leases. Power is given to postpone the payment of instalments of principal and interest due under mortgages. Power is also given whereby such provisions of the Discharged Soldiers Settlement Act as may be defined can be applied, when the time is deemed opportune, to persons who, while domiciled in New Zealand, have served beyond New Zealand in the King's Forces in any war other than the recent war with Germany.

THE SECOND-HAND FRUIT-CASE AS A SOURCE OF FUNGOUS-DISEASE INFECTION.

G. H. CUNNINGHAM, Biological Laboratory, Wellington.

LAST month the Department's Fruit Inspector at Dunedin (Mr. C. C. Dyke) forwarded to this Laboratory an empty fruit-crate for examination. His request was that examination be made for the presence of the conidia of brown-rot (*Sclerotinia cinerea* Schroet.), as the contents of the case—peaches—had been condemned by him for this disease on 3rd March. The crate had been lying in a fumigator until 24th March, when it was despatched, without any protective covering, to the Laboratory.

As it is impossible to examine an opaque object satisfactorily with the microscope with a magnification sufficient to identify brown-rot spores the following procedure was adopted: The crate was taken to pieces, and each board was then scrubbed with a stiff brush dipped in water. The washings were carefully preserved, and when all the boards had been treated the water (which was now much discoloured) was placed in tubes in a centrifuge, which was kept in motion for five minutes. This process precipitated the suspended matter to the bottom of the tubes. The precipitate was treated several times in such a manner that the major portion, consisting principally of minute particles of sand, was got rid of, and a suspension of matter fairly free of sand was obtained. When this suspension was examined under

the microscope it was found to contain myriads of fungus spores, as well as fragments of fungus hyphæ, and particles or organic matter such as cells of wood, diatoms, &c.

Among many that could not be identified, spores of fungi belonging to the following genera were determined: *Alternaria, Ascochyta, Cladosporium,* Clasterosporium carpophilum* Aderh.,* *Cytospora,* Dematium, Diplodia, Gloeosporium* (or *Colletotrichum*),* *Macrophoma,* Macrosporium, Penicillium, Phoma* (or *Phyllosticta*),* *Pleospora, Puccinia graminis* Pers. (uredospores), *Puccinia Pruni-spinosae* Pers. (uredo- and teleuto-spores),* *Rhizopus,* Sclerotinia cinerea* Schroet.,* and *Uromycladium notabile* McAlp. (teleutospores). Many were numerous, particularly brown-rot, sixty-two conidia of this species being counted in the field of the microscope at one time.

To determine whether the brown-rot spores were viable or not the following inoculation experiments were carried out by Mr. R. Waters, of this Laboratory: Mature peach-fruits, free from skin-injuries, were obtained, and a number subjected to surface sterilization by immersion for ten minutes in corrosive-sublimate solution (1–1,000). As this treatment tended to injure the epidermis a second series of inoculation experiments was carried out with fruits that were not subjected to any surface sterilization. The appended tables show the experiments carried out and the results.

In experiments 1, 2, 7, and 8 a suspension of spores taken from the centrifuge-tube was used; this was added as a drop to the surface, and in experiments 1 and 7 a needle was thrust several times through the drop into the tissues. In experiments 3, 4, 9, and 10 conidia were obtained from a pure culture of brown-rot grown on 4-per-cent. agar. This culture was obtained from Dr. J. W. Roberts, of the United States Department of Agriculture, with a view to determining whether the American and New Zealand organisms were the same. In experiments 11 and 12 conidia from fruits infected with the New Zealand organism were used. Experiments 5, 6, 13, and 14 were used as controls, and as no brown-rot developed on any of these it becomes obvious that where brown-rot developed it was due to infection from material used and not from contamination. The inoculated peaches were placed in cylinders plugged with cotton-wool and kept in an incubator set to a temperature of 27° C. (81° F.).

From these experiments it would appear that cases that have contained fruit infected with brown-rot are capable of carrying viable conidia of this organism for at least a month. Judging from the weak infection following inoculations in experiments 1 and 7 it would appear that but a very few of the spores are capable of infecting fruits after being separated from the host for a month. This may be due to the spores being subjected to the unusual dry conditions of a fruit-crate, as on seasoned wood but little moisture would be present. Moreover, the crate in question was stored for twenty-one days in a fumigator (which was not used during this period) where the atmosphere would be anything but humid.

Although cases are capable of carrying brown-rot it is significant that this disease has not yet made its appearance in the orchards of Central Otago. It would thus appear that *orchard* infection from

* Genus containing species which are parasitic on fruits.

contaminated cases is a negligible contingency. Fruits packed in second-hand cases, however, may evidently become infected in transit, as Central Otago fruits have been frequently condemned in the markets of Dunedin for this disease.

As the experiments show that second-hand cases are a source of fruit-infection it becomes obvious that properly these cases should be subjected to sterilization treatment before being used. Experiments are now being carried out at this Laboratory with the object of developing some rapid, effective, and cheap means of treating second-hand cases. Results will be published in a subsequent number of the *Journal*.

Table I.—Fruits immersed for Ten Minutes in 1-1,000 Corrosive-sublimate Solution.

Experiment No.	Inoculum used.	Treatment of Epidermis.	Result of Experiment.
1	Centrifuge suspension ..	Punctured with needle	Weak brown-rot and *Rhizopus** infection developed after seventy-two hours.
2	Centrifuge suspension ..	Uninjured ..	Nil.
3	Conidia from pure culture of American brown-rot	Punctured with needle	Brown-rot developed in forty-eight hours.
4	Ditto	Uninjured ..	Nil.
5	Distilled water	Punctured with needle	,,
6	,, ...	Uninjured ..	,,

* *Rhizopus nigricans* is a rot common on stone-fruits in New Zealand; in Otago it is commonly mistaken for brown-rot.

Table II.—Fruits not subjected to Surface Sterilization.

Experiment No.	Inoculum used.	Treatment of Epidermis.	Result of Experiment.
7	Centrifuge suspension ..	Punctured with needle	Weak infection of brown rot after seventy-two hours.
8	Ditto	Uninjured ..	Nil.
9	Conidia from pure culture of American brown-rot	Punctured with needle	Brown-rot developed in forty-eight hours.
10	Ditto	Uninjured ..	Nil.
11	Conidia from fruit infected by New Zealand brown-rot	Punctured with needle	Brown-rot developed in twenty-four hours.
12	Ditto	Uninjured ..	Nil.
13	Distilled water ..	Punctured with needle	,,
14	Ditto	Uninjured ..	,,

Noxious Weeds.—Cape honey-flower (*Melianthus major*) and cut-leaved psoralea (*Psoralea pinnata*) have been added to the Third Schedule of the Noxious Weeds Act, this schedule comprising plants which may be declared by local authorities to be noxious weeds within the districts under their jurisdiction. The Whakatane Borough Council has declared hawthorn to be a noxious weed in the district under its jurisdiction.

WORK FOR THE COMING MONTH.

THE ORCHARD.

During the past month 53,240 packages of apples and pears have been exported to the United Kingdom, making a total to date this season of 68,555 packages. It is expected that a further total of about 44,000 packages will be shipped to the same destination before the season closes. In addition, arrangements are being made for a small shipment to the South American market. Most of the fruit exported is coming from the Nelson Province. Hawke's Bay and Marlborough are also supplying a fair quota. Much interest is being centred in the pioneer shipment from the Otago District this season, where arrangements are well in hand for the export of some 5,000 cases of apples. Those who are acquainted with the fine quality of the fruit grown in the Central Otago dry areas will know that the good name of New Zealand fruit on the markets of the world will not be jeopardized by the Otago growers entering into the export trade, and every good wish may be extended to them for success in their initial effort.

The time of the Fruitgrowers' Federation annual conference is again fast approaching, and organizations in the various districts will no doubt be framing their remits for consideration at that gathering. As the fruit industry progresses the importance of these assemblies increases, and every endeavour should be made to strengthen the existing organizations so that those engaged in the industry may be heard with one accord, and thus establish their business on a sound footing.

—*W. T. Goodwin, Assistant Director of the Horticulture Division.*

AUCKLAND.

May can be regarded by the orchardist as the close of the fruit season, and attention may be given almost entirely to a general cleaning-up of the orchard sheds, spraying-apparatus, &c. This work should include the collection and burning of all mummified fruits that may be still hanging on the trees or lying on the ground. The first attention should be given to a thorough inspection of all orchard-trees for signs of infection by fireblight, and if such is detected it should be immediately cut out, making the cut well below the lowest point of visible infection on any individual branch and destroying all infected parts by burning. The wound should then be painted over with disinfectant as a prevention against further infection, and pruning-instruments should be sterilized after each cut is made.

Intending planters are advised to get the work of preparation of ground for planting well in hand. If left until after May the ground will probably be in too wet a state to permit the carrying-out of successful work, more especially on the heavier class of gum lands.

Spraying for woolly aphis and San Jose scale on apple-trees may be carried out at the end of May with red oil. 1–25.

—*J. W. Collard, Orchard Instructor, Auckland.*

HAWKE'S BAY.

The marketing of late varieties of fruit will require close attention. Other seasonable work will be a thorough clean-up of the orchard. All waste fruit should be cleaned up; props, spare cases, &c., stowed away; sheds cleaned out; spray plant overhauled; and refuse removed from drains.

The land should be ploughed towards the trees, leaving the furrow in the centre of the rows. Plough with the fall of the land to provide a runway for surplus water should the winter prove to be a wet one. Neglect of this precaution causes the formation of a waterlogged area in many orchards, and often leads to a considerable loss of root-system due to decay.

Pruning of stone-fruit trees should be done as soon as the trees are in fit condition. It may be done any time after the foliage has fallen, and should be proceeded with immediately to avoid a rush of work later on.

Pest and disease control: Stone-fruit trees—The fall of the leaf has proved a good time to apply bordeaux, 8–6–40, for such diseases as die-back, shot-hole, and rust. Trees which are also infected with San Jose scale may be sprayed to better advantage with lime-sulphur, 1–15. Apples and pears—Where woolly aphis is present, oil, 1–25, should be applied at leaf-fall. Trees on which pear-mite or San Jose scale has been noticed during the season should be sprayed with lime-sulphur, 1–15, just prior to leaf-fall.

—*W. H. Rice, Orchard Instructor, Hastings.*

NELSON.

We have now arrived at the interval between the orchard seasons. The harvest is over; the fruit has been placed on the market or in the store; cover-crops are forming bright strips through the orchard rows, and the trees, relieved of their burden and cleaned up by spraying, are recovering themselves. The time has arrived when the grower should carefully consider the experience of the past season—its successes, failures, and difficulties. While the experience is fresh in the mind he should peruse the orchard log or diary, and after weighing the pros and cons make plans for the coming season. Each orchard has its special problems, and these must receive consideration before making plans or buying stores for the future.

The matter of planting or reworking varieties demands special attention at the present time. Buyers are becoming more conservative in their demand for standard varieties, and it would often pay to rework other sorts. Planters are recommended to avoid experiments at the present time.

Orchard-shelter is of more importance here than some think, and many an orchard would be vastly improved by a plantation or row of shelter-trees properly placed.

Of the jobs requiring more immediate attention drainage stands first. Our greatest difficulties in Nelson orchards arise from defective drainage. Many orchards have hills at the back, and an open course has to be maintained for a very sharp fresh at times. From these watercourses obstructions must be removed and the banks made secure, while open drains will require the sides trimmed down and the bottoms cleaned out. Lack of growth, poor foliage, small fruit, spray-burning, and black-spot fungus are often the result of land being waterlogged for a period. On trees on such land sprays will burn unless very weak, while on the soil itself lime and fertilizers are thrown away, and cultivation only makes matters worse unless it is drained.

—*W. C. Hyde, Orchard Instructor, Nelson.*

CANTERBURY.

Pests and diseases: For woolly aphis, when the fruit has been picked, good results can be obtained by spraying the trees with emulsified red oil, 1–60, or with Black Leaf 40, 1–800. Stone-fruit growers should gather and destroy all mummified fruits, and thus prevent a carry-over of brown-rot disease through this means. Earnest attention will have to be given to measures for controlling this disease during the coming season. Trees affected with peach leaf-curl, brown-rot, shot-hole fungus, pocket-plum, and rust should be sprayed thoroughly with bordeaux, 6–4–50, when the leaves are beginning to fall.

Storing the crop: When these notes appear the harvesting of the crop will be practically finished for this season. Growers who stored mid-season fruit in sheds should examine it at frequent intervals, and market without delay immediately it begins to show signs of going off. Stored fruit should always be repacked before being placed on the market.

Drainage: The drainage of heavy retentive soils should not be neglected. Tile drains, though more expensive, are the more permanent type of drain and give the best results. The diameter of tiles for main drains should be 4 in. Existing open drains should be cleaned out, and the outlets to pipe drains cleared so as to let the water pass freely away. Drainage permits of the land being worked earlier in the spring, makes it easier to work, and prevents souring of the soil. Drained soil is also much more congenial for the roots of the trees.

Preparations for planting: If planting is intended this season the land, if not already cultivated, should now be thoroughly worked up and made ready. Good deep working is what is required, and no effort should be spared to put the soil in good order. After the trees are planted the land cannot be cultivated to the same extent as now.

Orchard-sanitation: The period between the completion of picking fruit and the commencement of winter work should be devoted to a thorough clean-up of the orchard. Any previous prunings which have been left lying about the orchard should be destroyed at once. Orchard-boxes should be repaired and stacked away in a dry place for next season. The props used in supporting this season's fruit-laden branches should be gathered up and stacked away in some convenient place.

The coming season's spraying programme for the control of pests and diseases in the orchard should now be carefully considered. The Orchard Instructor will be pleased to assist any grower in this matter. All growers are cordially invited to visit the experimental orchard, Harewood Road, Papanui, Christchurch, for the purpose of seeing what is being done there.

—W. K. Dallis, Orchard Instructor, Christchurch.

OTAGO.

Immediately the gathering of fruit is completed it will be found advisable, where powdery mildew has been present, to spray with lime-sulphur, 1–25, or atomic sulphur, 10 lb. to 100 gallons water, in order to lessen the danger of reinfection for next season.

For brown-rot in stone-fruits all infected fruits should be gathered, and any lying on the ground destroyed by burning or by burying deep enough under the soil to prevent ploughing up to the surface next spring. If not already done, the trees should be sprayed with bordeaux, 8–6–40, as this will assist to kill the spores of the disease. This strength of bordeaux will also be found of great assistance in checking peach-rust.

Where woolly aphis is prevalent a spraying of red-oil emulsion, 1–60, is found very effective immediately after the crop is picked.

—B. G. Goodwin, Orchard Instructor, Dunedin.

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

CARE OF THE PULLETS.

Now that the season of the year has been reached when unfavourable weather conditions may be expected the making of the pullets comfortable and managing them to the best advantage as a means of encouraging the birds to give a good winter egg-yield is a matter for first consideration on the part of the poultry-keeper. A great essential in this connection is that the sleeping-quarters be well ventilated but free from draughts, and, above all things, the birds must not be overcrowded. Neglect of these important details is only inviting trouble in the form of colds, the forerunner of that dreaded disease roup. Of late I have been called upon to advise in several cases where well-developed colds in pullets were present, and in each case the cause was traced to the lack of fresh air or to draughty quarters.

The first symptoms of colds are sneezing, eyes watering, and a discharge from the nostrils. When birds show any of these symptoms they should be isolated at once as a prevention of the trouble spreading. The next step should be to find the cause and remove it, and for this purpose it is a good plan to visit the house by night. It may be found that the ventilation is insufficient, or that there are cracks in the back or side walls whereby the birds are sleeping in a draught. A good way of testing the latter is to hold a lighted match or candle along the walls where the birds are roosting. If its movements indicate that a draught is present the matter should be corrected at once. While it is true that a crack in the wall may give only one bird a cold, it must be remembered that the germs from this one, chiefly through being left in the drinking-water, may soon cause the whole flock to become affected. As a general rule, when colds make their appearance the poultry-keeper resorts to one of the many cures recommended for this trouble, and quite overlooks the great essential of first discovering and removing the cause. The curing of colds is all right in its way, but this is only endeavouring to stamp out the trouble when the damage has been done, for once a bird becomes affected in this way it rapidly declines in health, with a consequent reduction in egg-yield, in spite of the best of food and attention which it may receive.

Not unlike most other troubles affecting poultry, colds can be satisfactorily kept at bay by preventive methods, the chief factors being clean, well-ventilated, and draught-proof quarters. In addition, late hatching should never be resorted to, as the bird brought out in the late season is most susceptible not only to colds, but also to practically every other passing ailment. As to a cure, or rather a means of checking the spread of colds, it is a good plan to place some kerosene in the drinking-water—say, half a teaspoonful to 2 quarts of drinking-water at the start, and increasing this to a full teaspoonful by degrees as the birds become accustomed to it. This treatment may be given three times a week, and on such days no other water should be given to drink. A few Condy's crystals put into the drinking-water at various times is also recommended for checking colds.

In addition to comfortable housing, the pullets which are to produce a heavy winter egg-yield must have an abundance of good wholesome food. The morining mash may consist of 2 parts good-quality wheatmeal to 1 of bran, this being moistened with meat-soup or skim-milk. When the latter are not available hot water should be used. Hot water makes the mixture far more appetizing than does cold, and the more appetizing is the food a laying-bird receives the better will the result be in eggs. To enable a bird to do her best at this period of the year some form of animal food is imperative. When boiled meat is not available a good grade of meat-meal should be placed in a separate hopper and left for the birds to pick at when required. The evening meal may consist of equal parts of wheat, maize, and short plump oats, fed in litter as a means of providing exercise and keeping the birds busy. Exercise is essential if a healthy thriving flock is to be maintained. On no account should the provision of an ample supply of green stuff, gravel-grit, crushed oyster-shell, and clean water be neglected. In addition to the other food it is a good plan to feed a dry mash in a separate receptacle, leaving this before the birds at all times. The following makes a suitable mixture for this purpose: 55 lb. good-grade pollard, 17 lb. bran, 12 lb. maize-meal, and 10 lb. crushed oats. Of course, different quantities can be mixed to suit individual cases. When good pollard is not available wheatmeal is recommended, but in a slightly reduced quantity. While the great essential in feeding poultry is to secure the greatest profit over the cost of production, it seldom or never pays to feed an inferior foodstuff. It will usually be found that the best quality, even though it may cost a little more, will prove the cheapest in the long-run. The man who stints his fowls or gives them a poor-quality ration seldom or never makes a success of the business.

Another important matter is to see that the quarters are kept absolutely free from vermin. If the laying-bird is to return a high yield of winter eggs, which must be regarded as an artificially stimulated product, she must surely be made happy and contented. Obviously this will be impossible if she is to be continually tortured by parasite life. During my visits for instructional purposes and for investigating troubles in poultry it is surprising the number of poultry-men who, when asked if there are any red mite, fleas, &c., present, will admit that there are a few. Usually, however, when a personal and close examination of the quarters is made it is soon discovered that the latter are infested with the pests, these too often being the sole cause of the weakened condition of the stock. As an instance, on making an investigation the other day regarding the reason for seven-months-old pullets not laying and refusing to perch on the roosts provided, the cause was soon made apparent. The perches, dropping-boards, &c., were found to be alive with red mite. In the circumstances it was little wonder that eggs were not forthcoming, and that the birds preferred to roost in odd corners of the house rather than on the perches. The presence of vermin is undoubtedly the weak point in many unsuccessful plants. The provision of good dust-baths, keeping the quarters thoroughly clean, and frequently spraying the interior of the house, nest-boxes, perches, &c., with a strong disinfectant form the keynote in preventing insect pests from making their appearance.

THE APIARY.

F. A. JACOBSEN, Apiary Instructor.

THE season's honey crop has now been gathered, and the majority of apiaries have been prepared for winter. Contrary to earlier expectations, the quantity of honey has been disappointing, due to abnormal climatic conditions. Quality has also suffered to some extent on account of the same cause, a moisture-charged

atmosphere having made the ripening process difficult, resulting in the general crop being comparatively thin and watery. It is to be hoped that the keeping-quality will not be seriously impaired.

BETTER BEEKEEPING: SOME CARDINAL POINTS.

It is impossible to keep bees with profit in common boxes. They must be in movable frame hives and given a certain amount of care and labour.

Bees need protection from cold and wind in all parts of the country in which the winter temperature frequently reaches freezing-point. In very cold countries bees are wintered in cellars to conserve the heat, or are placed in huge cases packed with some warm material. In New Zealand these precautions are not necessary, but nevertheless a sheltered position is advantageous and lessens the consumption of winter stores.

In the autumn an average colony of bees should be left with sealed winter stores approximating 40 lb. It is a wise policy to ensure such a quantity being left, so that a constitutionally sound colony may emerge in the spring. At the latter season also there should be plenty of stores to enable breeding to be prosecuted until spring feed is available. Colonies also require protection and plenty of room for brood-rearing during spring.

Swarming during a honey-flow is undesirable if a crop is required. Preventive measures include the use of a young queen, plenty of breeding-room, and adequate ventilation during hot weather.

During a honey-flow colonies should be given ample storage room. Failure in this respect may result in half the crop being lost.

The cultivation of plants or flowers for bees alone does not pay, but the planting of nectar-producing flora which also serve another purpose is advantageous. If at any time the bees are short of stores, feed sugar-syrup, but avoid the use of other than granulated sugar, and do not use inferior grades, molasses, or glucose. Do not let the bees starve, or even get so short of stores that they decrease brood-rearing before a honey-flow.

The successful beekeeper is he who studies his bees and is prompt with his manipulations. Beekeeping is not a paying business for the shiftless man. Although specializing in beekeeping may be most advantageous from the standpoint of the advancement of the industry, there is no reason why a few colonies of bees should not be profitable, provided the owner gives them adequate and intelligent care.

VITICULTURE.

J. C. WOODFIN, Vine and Wine Instructor.

THE VINEHOUSE.

THE only grapes now on the vines will be those that are left of the late varieties, such as Gros Coleman, Gros Maroc, Alicante, Lady Downes, and Pearson's Golden Queen. Lady Downes appears to hang longer in good condition than any of the others mentioned, and this variety will keep till June in a dry place. Short days and an increasingly damp atmosphere are the difficulties now to contend with. The house must be kept as dry as possible and with as little variation in temperature as can be managed. If it is desired to keep the grapes as long as possible there must be no pot-plants in the house, as the necessary watering would keep the atmosphere damp. The leaves transpire moisture, and during the night this moisture condenses on the foliage, fruit, and roof-glass. This condensed moisture must be dispersed early in the morning, or decay of the fruit will ensue, and if there is plenty of space between the foliage and the glass, as there should be, there will be no difficulty in doing this.

The vines continue to make growth till quite late in the autumn, and left to themselves the sublaterals would soon fill up the air-space. This must not be allowed. A little freedom of growth is advisable, but it should not be allowed to an extent sufficient to bar the free passage of air between the roof-glass and the foliage of the vine. A matted condition of laterals should not be permitted, even if it does not crowd up to the glass, for such a state would prevent the proper drying of the foliage and create a condition of dampness that would render it impossible to keep the grapes hanging.

The house should be kept as clean as possible. Any leaves that may have reached maturity and fallen off should be collected and taken away, as well as lateral growths that may be cut off.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

THE vegetable-garden is a place where a comparatively intensive system of cultivation is practised. The soil therein should be in a condition to enable a succession of vegetables to be grown, so that a supply may be available all the year round. As in some circumstances a considerable amount of labour may be necessary to bring the soil into a suitable state, and as the greatest degree of success is attained only by keeping the area thoroughly cultivated, the space allotted should be strictly limited to actual requirements. Deeply worked soil and good drainage are necessities. If these conditions do not obtain naturally they must be brought about by trenching and artificial draining. If the winter water-table is less than 3 ft. from the surface drainage is necessary. Excess water in the soil takes the place of air, which is necessary to fertility, and also makes the soil cold. Where frosts occur these are intensified, while even in frost-free places stagnation of growth results. Where new land is trenched the top soil should be kept on top, as it is more fertile than the subsoil, but when parts that have been under cultivation for a number of years are being re-trenched the top soil should be placed at the bottom, as the lower strata may now be the richest in plant-food. In this case the subsoil has been previously broken up, and, the top spit having been in a state of cultivation, the subsoil will have become sweetened by aeration and therefore be in a fit state to grow crops.

Current Work.

Young crops of turnips now coming on should be kept clean until the tops cover the ground. White varieties intended for first use need not be thinned much. Thinning can be done by drawing roots as they are large enough for use, and by this means a very heavy crop can be taken. Yellow-fleshed varieties intended to stand through the winter must be thinned to allow each root room to develop; the earlier this is done the better.

Cabbages of the earliest kinds sown in February should be ready for planting out. Plant in well-drained soil in the warmest situation available, with blood-and-bone as a fertilizer. It is not advisable to give a special nitrogenous fertilizer at this time, as such would tend to make the growth soft, and consequently render the plant more susceptible to cold weather.

Winter rhubarb should now be in use. Never pull a stool quite bare, but leave some stalks to keep growth going. At each pulling take the older stalks, so as to take every stalk in its turn and avoid leaving any to get tough. As regards summer rhubarb, it was formerly the custom to lift the stools every second or third winter and replant in spring, no produce being taken the first year after planting. This is not now generally practised. It has been found that the spring crop may be taken, and the stools lifted in November or December, cut up, and at once replanted. They then become established during summer and autumn, and are ready for pulling the following spring. By this plan the spring crop is secured, and this one is the most valuable.

Peas of an early kind may be sown during May in most places. Where slugs or birds are troublesome, damage can be prevented by supporting the rows with sticks. Birds never disturb them when so protected, and the damage from slugs is negligible.

SOME COMMON GARDEN DISEASES AND PESTS.

Club-root (Plasmodiophora brassicae).—This very widespread trouble affects nearly if not all crops belonging to the order Cruciferæ, such as turnips, swedes, radishes, kohlrabi, rape, cabbages, cauliflowers, &c. The disease is caused by a soil-fungus, and is extremely infectious. If parts of a diseased root or soil from infected ground be by any means conveyed to a clean plot, that plot becomes infected. Infected soil may be carried on cart-wheels, on horses' hoofs, or on the boots of the workmen. The disease does not spread from plant to plant through the air. Thus only parts of a field may be infected; sometimes only a plant here and there, according to the degree of infection. The cause of the trouble is a fungus so small as to be perceptible only by the aid of a strong microscope. This minute organism is capable of living in the soil in a quiescent condition for years, but when a crop it can attack is planted on the ground it enters the fine roots,

multiplies rapidly in the tissues, and induces malformation and decay. The presence of the fungus is due to an acid state of soil. Authorities state that it has never been known to occur in soil that contained a sufficiency of lime. It must not, however, be supposed that the application of lime will effect an immediate cure; some four years are required for lime to clear the soil of club-root, but it does do so in that time, and afterwards it is safe to plant crops liable to infection. In the meantime crops not subject to club-root should be grown on such land. It is to be remembered that most of the fertilizers commonly used are of an acid nature, and unless the acid is compensated by lime an acid condition of soil is sure to result. Club-root is said to have been unknown before the advent of artificial fertilizers.

Slugs and Snails.—These are damp-weather pests; for that reason they are most troublesome in spring and give very little trouble during summer, unless the season happens to be abnormally wet. The control of these pests is largely a matter of clean cultivation and maintenance of the immediate surroundings of the garden in a clean condition. Crops should be kept free of weeds, and when finished the debris should be cleared away. When carrots or turnips are pulled the tops should not be left on the bed; carry the roots off the plot before trimming the tops off. Cabbage-leaves should not be left lying on the ground among the plants. All such debris harbours slugs and snails, and protects them against hoeing or liming. It should be placed in a common heap and freely dusted over with air-slaked burnt lime. The immediate surroundings are also a frequent source of trouble. It is practically useless to attempt control if long grass or accumulations of decaying rubbish are left alongside the plots. Shelter hedges make another good harbour for snails. Long grass should be cut away, and rubbish and fallen leaves raked out. It is the clean garden that is the least troubled by these pests. A good many plans for control have been suggested and tried, but most people agree that liming is most effective. The work is the least trouble if done in the early morning. As soon as the sun begins to rise slugs and snails seek shelter. They are easily seen at this time, because they are moving. Snails are easily picked up and thrown into a tin in which is a little lime, while small snails and slugs should be sprinkled with lime. A mere dusting with lime is not sufficient, however, as slugs can cast their skin and crawl out; give a good sprinkle, and they cannot escape. Those who prefer it can work in the evening after dark, but this is more troublesome, as the help of a lantern is necessary and the vermin must be looked for on the plants. However, a more liberal use of lime makes the task somewhat easier, and there is the satisfaction of knowing they will not be feeding all night on the crops.

Woodlice.—The woodlouse (*Oniscus asellus*) is not an insect, but belongs to the crustacea, the order of which the crab and lobster are also members. Woodlice feed by night, and during the day hide in any quiet place which is a little damp—in crevices in fences and buildings, under or between boards, among rubbish of any kind, in hay or straw, in parts of a manure-heap where there is no violent fermentation, in old brick walls or heaps of bricks, and in cracks in the soil. These pests need be a serious trouble only where it is impossible to do away with their sheltering-places, or to subject them to sufficiently drastic treatment. Such conditions sometimes prevail in glasshouses, where woodlice are at times a source of great trouble. In the open ground they are rarely difficult to deal with. Rubbish-heaps should be disposed of by burning or otherwise; decaying timber should not be left about; where good timber is stacked it should be on cross-pieces so as to keep it clear of the ground; loose straw around manure-heaps should be raked up and burned; the surface soil should be cultivated so as to leave no cracks; and boiling water should be poured into crevices in fences, &c., where they harbour, this killing them instantly. Woodlice never harbour in places that are frequently disturbed. Poultry of all kinds greedily devour them, and where it is convenient to let these run for a time they will quickly clean up the woodlice.

Wireworms.—These are the larvæ of a beetle; their chief habitat is grass-land, and their chief food the roots of plants. Wireworms are frequently numerous on newly broken up pasture land. Means of suppression include thorough and frequent cultivation so that they may be brought to the surface, when birds will pick them up; dressings of salt up to 6 cwt. or 8 cwt. per acre (kainit is a useful potassic fertilizer to use, as it contains a considerable amount of salt); and a free use of air-slaked burnt lime and soot. Where the pests are very numerous among growing crops they can be trapped by burying pieces of carrot or potato just below the surface. The traps should be examined every day or two and the wireworms removed.

Millipedes.—These are somewhat similar to and are frequently mistaken for wireworms. They may be distinguished by their greater number of legs, by their brown colour (wireworms being black), and by the presence of two horns on the head. The larvæ feed on the roots of potatoes, onions, carrots, turnips, cabbages, &c. The best remedy is frequent hoeing and the strewing of lime and soot on the ground. Avoid the use of rank manure where millipedes are present.

Eelworms.—Eelworms, commonly known as nematodes, are considered to be encouraged in the first place by an overabundance of organic matter or fertilizers bringing about an acid condition of soil. The increase of the pest is said to be assisted by wetness of the soil, which increases the acidity. If these statements are true—and there is no reason to suppose they are not—then the necessity for good drainage is emphasized. Stable or farmyard manure in the condition known as "fat" should be used only in moderation. Lime is of the greatest importance; besides other properties which need not be considered here, it corrects acidity in organic manures and humus, which is caused by most of the artificial fertilizers in common use. Where badly infected soil must be cropped it is said to be a good plan to sow mustard between the crops. Eelworms have a great liking for the mustard-plant, and will enter its roots in preference to those of other plants. The mustard should be pulled up and burned after the female worms have entered the roots. This, however, evidently requires an accurate knowledge of the life-history of the pest. There are several ways of cleaning the soil by fumigation, but the methods are too costly for field-work. It has been demonstrated that a year's fallow, keeping the soil meanwhile clean and frequently cultivated, is more effective in destroying eelworms than are soil-fumigants.

PRECAUTIONS AGAINST SPREAD OF FIREBLIGHT.

REGULATIONS under the Orchard and Garden Diseases Act, prohibiting the removal of certain plants and of bees from portions of the Taranaki and Wellington Land Districts where fireblight was recently discovered, were gazetted on 30th March, as follows:—

1. In these regulations "prescribed area" means all that area in the Taranaki and Wellington Land Districts, in the counties of Patea and Waitotara, bounded by a line commencing at the mouth of the Manawapou Stream, and proceeding thence along the north-western, northern, and eastern boundaries of the Patea County as defined in the *New Zealand Gazette*, 1920, page 3207, to Pakira Trig. Station at the easternmost corner of Section 11, Block XIV, Omahaki Survey District; thence along a right line to the source of the Kai Iwi Stream, and down that stream to the sea; thence north-westerly along the sea-coast to the place of commencement.

2. No plant or portion of a plant of any variety of apple, pear, quince, or cratægus shall be sent or brought from the prescribed area into any other portion of New Zealand: Provided that nothing in this regulation shall apply to the sending by an officer of the Department of Agriculture, under proper safeguards, of plants or portions of plants of any of the above-mentioned kinds from the prescribed area for the purpose of the identification of disease.

3. (1.) Every package of trees or shrubs, or portions of trees or shrubs, sent from the prescribed area to any other portion of New Zealand must be accompanied by a certificate, in the form set out in the Schedule hereto, signed by the consignor, that no plant or portion of a plant of any variety of apple, pear, quince, or cratægus is contained in the package. (2.) The certificate shall be endorsed on a tag or label securely attached to the package in a prominent position.

4. No bees shall be sent or brought from the prescribed area to any other portion of New Zealand.

5. Every person who does or omits any act in contravention of these regulations commits an offence, and is liable on conviction to a fine not exceeding £20.

The Waikato Form of Barberry.—In the fourth paragraph of the article on this subject in last month's *Journal* (p. 159) it was stated that in hedge-establishment the plants are planted out 3 ft. apart. This should have read 12 in. to 15 in. apart.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

FOUL-IN-THE-FOOT OF COWS.

W. J. MARSH, Urenui :—

Three of my cows are badly affected with foot-rot. Could you let me know the cause and cure of this trouble ?

The Live-stock Division :—

Foul-in-the-foot of cows is usually the result of some foreign substance becoming lodged in the space between the claws. It may also be the result of allowing the claws to grow too long. If from the former, the offending body should be removed and the foot steeped in a hot disinfecting solution. A pad of wool saturated with carbolic oil should then be placed in the cleft and held in place by a bandage. In aggravated cases, where ulceration has taken place, all dead material should be removed, and, after washing, the part should be smeared with a strong carbolic solution and treated as above. If pus should have underrun the horn the latter must be pared away to allow the discharge to escape, and dressings applied as recommended. If due to excessive growth of horn a sufficient amount of the claw should be removed either with a saw or chisel.

PROPAGATING CHINESE PRIVET FROM CUTTINGS.

J. GILLIAND, Lowcliffe :—

I intended planting privet-cuttings to form a hedge, and should like information as to the proper time to plant, the length of cuttings, and whether last season's growth is the best to use.

The Horticulture Division :—

The cuttings should be of the last growth made, 12 in. to 15 in. long. The Chinese privet, which is the one recommended, does not root so readily as other species. We find it best to take them with a heel of old wood, which means that the cuttings are pulled off instead of cut off. They root well in some places, however, if cut just below a joint. The cuttings must be raised in nursery rows in good friable soil, placing them 4 in. or 5 in. apart in the rows. The soil must be trodden firmly about the base of the cuttings, leaving it loose on the surface. Bury about half of the cutting. The best time for putting in cuttings depends on the climate and soil, extending from May to August inclusive. July and August are the best months for places where the soil is wet and cold through winter. Where spring is usually dry autumn cuttings do best.

COWS SUFFERING FROM ERGOT POISONING.

J. McK., Tiratu, Dannevirke :—

Will you please advise treatment for a cow with a lame hind leg? The leg is slightly swollen at the first joint from the hoof. After four or five days of this condition the hair came off just above the hoof at the back, and later a ring of hair right round the first joint came off as if cut with a knife. Several months ago I had another cow affected in the same way, and in this case the foot rotted off at the first joint after first shedding the shell of the hoof.

The Live-stock Division :—

Your cows are evidently suffering from the result of ergot poisoning. Ergot may affect most grasses, but principally rye-grass. Cattle should be removed from ergotized paddocks and be given a complete change of feed. Little else can be done. A liberal dose of oil should be administered, and half-dram doses of tannin given twice daily to neutralize any unabsorbed alkaloid present

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MANURING OF FRUIT-TREES.

"FARMER," Tauranga :—

What is the best manure for fruit-trees (some old) growing in loose loam containing fine pumice dust or sand, and what is the best time and quantity to apply? Most of the trees are apples.

The Horticulture Division :—

It may be said at the outset that lime is always necessary, and where this is deficient it should be applied at the rate of 2 tons per acre of the ground limestone (carbonate of lime). Fertilizers proper should be varied according to the soil and usual rainfall. Thus superphosphate tends to hasten maturity, which means that in certain conditions it shortens the growing-period. It is therefore appropriate for use where the soil is naturally wet or the summer rainfall heavy. It is not appropriate for use under dry conditions. In dry or moderately dry soil or conditions blood-and-bone manure is better. This probably would suit your case. The amount to use should be according to the size of the tree, varying from 20 lb. for large to 4 lb. for quite small trees, to be applied about July. Potash is necessary; it affects the fruit directly, and also stiffens the growth and renders plants less liable to attack by fungus blights. Nitrogen is necessary to promote vigour in the tree; it affects only the vegetative parts of a tree. Blood manure contains considerable amounts of potash and of nitrogen. Where blood manure is not used potash and nitrogen should be added, the former by sulphate of potash, 1 lb. for a medium-sized tree, while nitrogen can be supplied by nitrate of soda, using the same amount as of potash. This, however, should not be applied until the tree is in growth—about October. Where trees are lacking in vigour, whatever other fertilizers may have been used, nitrate of soda will usually restore vigour.

HEIFER WITH SUPERNUMERARY TEAT.

W. J. TAIT, Avondale :—

I have a Jersey heifer, due to calve in September, which has five teats, the odd one being in a direct line with the front and back teats on one side, but nearer the front one, and a little smaller than the others. As it may cause inconvenience in milking, can you recommend a simple method by which it could be removed without risk?

The Live-stock Division :—

The most simple method of removal is to cut the teat off. This is best accomplished by using a pair of surgical scissors, the end of the teat being held firmly in one hand, and with the scissors it should be clipped off close to the base. Before removal the parts should be smeared with tincture of iodine, a little of which should be applied daily until the wound has healed. The operation should be performed in the off season when the animal is not milking.

Price of Seed-wheat. — Under the Wheat-control Regulations the price of ordinary seed-wheat is 5d. per bushel above the miller's price for good milling-wheat; machine-dressed seed is allowed an extra 5d., or a premium of 10d. per bushel over good milling-wheat.

HONEY-EXPORT REGULATIONS.

FOLLOWING is the text of the new regulations relating to the export of honey from New Zealand. They supersede the regulations of 22nd November, 1915, and all amendments thereto.

1. For the purposes of these regulations—"Director" means the Director of the Horticulture Division of the Department of Agriculture: "Dominion" means the Dominion of New Zealand, exclusive of the Cook Islands: "Owner" means any owner, shipper, or consignor of honey, and includes the agent of any such owner, shipper, or consignor, and also includes, in the case of a company, the managing director, manager, secretary, or other principal officer of the company in New Zealand.

2. No honey shall be exported from the Dominion until it has been graded as hereinafter provided, and until the other provisions of these regulations have been complied with.

3. Honey shall not be exported from the Dominion excepting at the ports of Auckland, Wanganui, Wellington, Lyttelton, Timaru, Dunedin, and Bluff, and at such other ports as the Director may authorize and publicly notify from time to time.

4. The Director shall from time to time appoint and publicly notify stores as grading-stores for the purpose of grading honey.

5. (1.) The owner of the honey intended for export shall forward it to one of the appointed grading-stores not less than seven days before shipment. (2.) He shall at the same time give to the Grader at the grading-store to which the honey has been sent an advice-note in the form set out in the First Schedule hereto, or to the effect thereof. (3.) Where there is any noticeable difference in the class or standard of honey forwarded to an appointed grading-store in one lot and under one brand, the owner shall submit such honey in separate parcels, each parcel containing honey of a uniform class and standard, with a distinguishing mark on each package of honey in each such parcel, and the advice-note to the Grader shall show the distinguishing mark of each such parcel. (4.) Every person who wilfully supplies false information on any advice-note as aforesaid commits a breach of these regulations. (5.) Every owner of honey sending the same to any of the appointed grading-stores must make his own arrangements for the transit of the honey to and from the store, and also for its receipt, storage, opening-up for grading, repacking, delivery, shipment, and any other service, including insurance and protection from damage and loss of any kind. (6.) All honey submitted for grading must be granulated, and no honey will be graded unless it is granulated.

6. (1.) Honey intended for export shall be contained in clean strongly constructed tins or other containers approved by the Director. The tins shall not have been used for any other purpose, and shall be lacquered or oiled on the outside to prevent rusting. (2.) Each tin shall be provided with a leak-proof lid, not more than 3 in. in diameter, which is capable of being easily removed and replaced. After grading and prior to export all lids, except those known as screw tops, shall be secured by means of soldering or other method approved by the Director. (3.) The tins shall be packed in clean cases which shall have planed ends, and be constructed of strong well-seasoned timber, and strapped with metal strapping or wire. (4.) The weight of honey in any one case when contained in tins shall not exceed one hundred and twenty pounds.

7. (1.) The owner of honey for export shall, before sending it to an appointed grading-store, cause the packages to be clearly and indelibly branded with an export brand to be approved and registered by the Director as hereinafter provided. (2.) The brand shall contain the words "New Zealand Produce—Pure Honey," and the name of the owner; provided that either in lieu of or in combination with the name of the owner there may be used such other words or such designs as the Director may approve for the purpose. (3.) The net weight of the honey shall also be branded on the packages. (4.) A shipper's brand or mark may also be branded upon the packages. (5.) One end of each package shall be kept clear for the grade-mark to be placed thereon by the Grader.

8. (1.) Every person intending to ship honey for export shall make application to the Director, in the form set out in the Second Schedule hereto, or to the effect thereof, for the registration of the export brand prescribed in clause 7 of these regulations. (2.) The Director may, if in his opinion the use of the brand to which the application relates is not likely to lead to mistakes or confusion, approve and register the brand, and shall forthwith notify the applicant of the result of his application. (3.) No person shall use any export brand unless and until he has been notified by the Director that it has been registered. (4.) The Director may at any time, after giving one month's notice in writing to the owner thereof, cancel the registration of any export brand if satisfied that it has not been used during the preceding two years in connection with the export of honey.

9. For the purposes of grading, honey will be divided into five classes according to colour—viz., water-white, white, light amber, medium amber, and dark.

10. For the purposes of the grading of honey the maximum number of points that may be allotted in respect of the several qualities is as follows: Flavour, 50; colour, 10; condition, 15; grain or texture, 15; freedom from scum and froth, 10: total, 100 points.

11. (1.) The following will be the standards upon which the grades of honey will be determined: Special Grade, 94 to 100 points, both inclusive; A or Prime Grade, 88 to 93½ points, both inclusive; B or Good Grade, 80 to 87½ points, both inclusive. (2.) No charge will be made for grading, except in the case of honey withdrawn from the grading-store after having been graded and approved for export, in which case a charge of one-tenth of a penny per pound will be charged.

12. As soon as possible after grading any honey the Grader shall stamp on the packages containing the honey a mark (herein called the "grade-mark") indicating the grade of such honey, determined in accordance with these regulations; and shall also sign and deliver to the owner a certificate of the grade (herein called the "grade-certificate"), in the form set out in the Third Schedule hereto: Provided, however, that no grade-certificate shall be issued in respect of honey scoring less than 80 points in the grading, and no grade-mark shall be placed on any case containing any such honey; but in any such case a notification of the result of the grading shall be sent by the Grader to the owner of the honey.

13. No person shall remove from any appointed grading-store, except for the purpose of immediately shipping it for export beyond the Dominion, any honey for which a grade-certificate has been issued unless the grade-certificate is surrendered to the Grader, and the grade-mark upon the package has been erased.

14. If any honey, after being graded and prior to its export from the Dominion, is damaged or, in the opinion of any Grader, deteriorates, the owner of such honey shall, if and when directed by the Grader to do so, submit such honey for re-examination, and shall surrender to the Grader the grade-certificate issued in respect thereof.

15. No honey in respect of which the grade-certificate has been or ought to have been surrendered in accordance with the last two preceding regulations shall be exported until it has been resubmitted for grading and a new certificate has been issued in respect thereof.

16. No honey shall be exported from the Dominion which scores less than 80 points in the grading.

17. No honey shall be exported from the Dominion if the containers show any signs of leakage.

18. The decision of any Grader as to the quality, condition, or grade of any honey shall be conclusive, and no action or other proceeding shall lie against any Grader or against any other officer of the Crown, or against the Crown, in respect of any erroneous decision of a Grader as to such quality, condition, or grade.

19. Except as otherwise provided in these regulations, no person shall alter or obliterate wholly or partially, or cause to be altered or obliterated, any grade-mark, nor shall any person counterfeit or improperly impress any such grade-mark on any package containing honey or intended to contain honey.

20. Any person committing or concerned in committing a breach of these regulations is liable to a fine not exceeding £5.

CATTLE IN NEW ZEALAND: January, 1921.

Breed.	Bulls of all Ages for Stud only.	Cows and Heifers, Two Years and Over.	Heifers under Two Years Old, including Heifer Calves.	Steers, Two Years Old and Over.	Steers under Two Years Old, including Steer Calves.	Totals.
Purebred.						
Jersey	4,030	5,808	2,895	51	213	12,997
Friesian	1,458	2,359	1,188	8	78	5,091
Ayrshire	397	1,293	474	4	1	2,169
Shorthorn	1,910	4,705	1,782	41	147	8,585
Hereford	1,420	2,175	1,068	387	171	5,221
Polled Angus ..	997	1,380	559	413	194	3,543
Other purebreds ..	56	118	43	..	14	231
Total purebred ..	10,268	17,838	8,009	904	818	37,837
Crossbred, with predominating Strain of—						
Jersey and other Channel Island breeds	9,972	303,476	126,403	12,599	16,742	469,192
Friesian	5,164	117,183	47,987	20,886	18,911	210,131
Ayrshire	1,119	30,770	10,160	2,212	2,250	46,511
Shorthorn	6,865	191,880	110,665	291,909	209,347	810,666
Milking Shorthorn ..	16,985	579,873	219,610	31,514	34,977	882,950
Hereford	5,907	156,107	78,465	116,009	83,045	439,533
Polled Angus ..	2,724	78,385	35,114	47,579	35,187	199,019
Other crossbreds (principally for dairy purposes)	269	14,420	5,460	3,700	3,399	27,248
Other crossbreds (principally for beef purposes)	75	4,371	2,577	5,553	3,560	16,136
Total crossbred ..	49,080	1,476,465	636,462	531,961	407,418	3,101,386
Total cattle ..	59,348	1,494,303	644,471	532,865	408,236	3,139,223

FORTHCOMING WINTER SHOWS.

Otago A. and P. Society: Dunedin, 30th May to 3rd June.
Waikato Winter Show Association: Hamilton, 30th May to 3rd June.
Manawatu and West Coast A. and P. Association: Palmerston North (National Dairy Show), 20th to 23rd June.
Auckland A. and P. Association: Auckland, 3rd to 8th July.

(Agricultural and Pastoral Association secretaries are invited to supply dates and location of their shows.)

Changes in Subscribers' Addresses.—In notifying the Publisher of a change in address it is requested that the old address be supplied in addition to the one to which future issues of the *Journal* are to be mailed, as otherwise it is often very difficult, in the large subscription list, to trace subscribers by name alone.

Berkshire Pigs for Sale.—The Moumahaki Experimental Farm has for private sale a number of young pedigree Berkshire boars and sows. Particulars may be obtained by communicating with the Farm-manager—postal address, Waverley.